ASCIDIANS FROM THE PHILIPPINES AND ADJACENT WATERS.

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INTRODUCTION.

Although the ascidians of the Malay Archipelago have already been so much studied that it seems unlikely that many of the commoner and more widely distributed species have escaped discovery, the Philippine Islands form one of the parts of that region that have been but little investigated as far as their ascidian fauna is concerned. As a whole the Malay region is remarkably rich in ascidians, both in variety of form and number of individuals, and some 200 species have been recorded from it, but among these supposed species there are undoubtedly many synonyms. Several important expeditions that have made collections in the Malay region, the United States Exploring Expedition, the *Challenger* Expedition, and the *Siboga* Expedition, extended their operations into the southern part of the Philippine group, and though as a result of their work a considerable number of species of ascidians have been described or recorded from Philippine waters, the localities investigated were too few and too near together, and the amount of material too small to give anything approaching a complete view of the ascidian fauna.

The collection made by the *Albatross* Expedition affords for the first time an opportunity for a general and comprehensive study of the ascidians of the Philippines and their vicinity. That the collection falls very far short of containing all the species found there is very evident. Many forms obtained by other expeditions are not contained in it, and much more extensive collecting in the northern part of the group would have been desirable. Future collectors will find plenty of localities, quite extensive regions in fact, which have been passed by entirely, and they will no doubt add many species and some genera to the list of Philippine forms, yet the *Albatross* collection seems to be a sufficiently representative one to determine the general character of the ascidian fauna of the Philippines and its relation to that of the surrounding regions.

It clearly indicates that this fauna is an integral part of that of the Malay region, not a distinct and separate one, and that in the southern part, especially in the Sulu Archipelago, the abundance and variety of ascidians is very great. Proceeding northward among the islands, the ascidians appear to gradually diminish both in abundance and variety. The *Albatross* collection fails to give any indication that this decrease is compensated for by the appearance of northern forms ranging southward from the temperate regions of China and Japan. The very few forms common to these regions and the Philippines are widely distributed species whose presence does not signify any special faunal relationship between places where they happen to occur. The ascidian fauna of the Philippines is distinctly a tropical one. Its relations to that of the temperate portions of the Australian coast are in fact much closer than to those of the less distant regions on the north, since on account of the warm currents many tropical Malayan forms range southward along the east coast of Australia to and even through Bass Strait. In arriving at these conclusions the fact must be kept in mind that insufficient collecting has been done in the northern part of the Philippines, and the presence of certain northern forms there may yet be established, but it seems hardly likely that they occur there to such an extent as to render necessary any great modification of the views here expressed.

REVIEW OF LITERATURE.

Gould (1852–1856)[1] figures several ascidians from the Sulu Sea, but accompanies the illustrations with very little description or other information. On plate 52 of Gould's Atlas (1856) the following are shown:

Figs. 613, 613*a*. "Ascidian from Balabac Passage, Sooloo Sea." (This is apparently a compound species of the family Styelidae different from any collected by the *Albatross*, perhaps a member of the genus *Diandrocarpa*.)

Figs. 616, 616*a*. "EUCOELIUM ERUBESCENS G., of a spongy texture, attached to coral from the Sooloo Sea."

Figs. 617, 617*a*. "EUCOELIUM ———, from coral reef, Balabac Passage, Sooloo Sea." (The figures do not suffice to determine what these were, but it is possible that they are both identical with *Polysyncraton dubium* Sluiter of the present paper.)

Figs. 621, 621*a*, 621*b*. "NEPHTHEIS (?) ———, dredged from about 9 fathoms, Sooloo Sea." (This is *Nephthcis thompsoni* (Herdman) of the present paper.)

The *Challenger* Expedition, 1873–1876, collected a number of ascidians in Philippine waters which were described as species new to science by Herdman (1881, 1882, 1886) in the reports of that expedition. The list of them follows. The names for these species adopted

[1] See list of literature at the end of this paper.

by the present writer (when different from the original) are given in the second column.

*Polycarpa pedata*_____(*Pandocia pedata*).
*Polycarpa irregularis*_____(*Pandocia irregularis*).
*Synstyela incrustans*_____(*Diandrocarpa monocarpa*, var. *philippinensis*).
Botrylloides tyreum (syn. *B. purpureum*).
Botrylloides perspicuum.
Botrylloides perspicuum, var. *rubicundeum*.
Cystodytes philippinensis.
*Distaplia vallii*_____(*Holozoa vallii*).
*Colella thompsoni*_____(*Nephthcis thompsoni*).
*Leptoclinum moseleyi*_____(*Didemnum moseleyi*).
Leptoclinum albidum, var. *grande*_____(*Didemnum grande*).
Aplidium fumigatum.

Traustedt (1885) in listing the simple ascidians of the Pacific Ocean again records from the Philippines on Herdman's authority:

*Polycarpa irregularis*_____(*Pandocia irregularis*).
*Polycarpa pedata*_____(*Pandocia pedata*).

Herdman (1891) in his Revised Classification of the Tunicata again lists the forms collected by the *Challenger* Expedition.

The *Siboga* Expedition, though its collecting was mainly done in the Dutch possessions, extended its operations into the extreme southern part of the Philippine region and added a large number of species to the list. These were described by Sluiter in volumes 56*a* (1904) and 56*b* (1909) of the report of that expedition. The species recorded are as follows:

In volume 56*a* (1904):

Halocynthia jacatrensis (Sluiter), 1900___(*Pyura jacatrensis*).
Culeolus thysanotus, new species.
Styela procera Sluiter, 1885_____(*Pandocia procera*).
Styela thelyphanes, new species_____(*Pandocia thelyphanes*).
Styela circumarata, new species_____(*Pandocia circumarata*).
Botrylloides perspicuum Herdman, 1886.
Chelyosoma sibogae, new species.
Ascidia kreagra Sluiter, 1895_____(*Phallusia kreagra*).
Ascidia melanostoma Sluiter, 1885_____(*Phallusia melanostoma*).
Ecteinascidia diaphanis Sluiter, 1885.
Ecteinascidia garstangi Sluiter, 1887.

In volume 56*b* (1909):

Polycitor discolor, new species.
Cystodites rufus, new species.
Cystodites semicataphractus, new species.
Sycoza sedens, new species_____(*Polycitor sedens*).
Trididemnum granosum, new species.
Didemnum moseleyi (Herdman), 1886.
Didemnum digestum, new species.

Didemnum makropnous, new species.
Didemnum ramosum, new species.
Leptoclinum calificiforme, new species.
Diplosomoides molle Herdman, 1886.
Polyclinum mikropnous, new species.
Amaroucium craterifcrum, new species.
Atopogaster tropicum, new species.
Morchellium intercedens, new species----------(*Synoicum intercedens*).

Michaelsen (1904, p. 48) discusses again Herdman's (1886) *Synstyela incrustans* and shows that the Philippine specimen which Herdman included under that name is different from the others. He gives it the new name *Diandrocarpa monocarpa*, var. *philippinensis*.

Caullery (1909, p. 46), evidently through an oversight, implies that *Nephtheis* [*Oxycorynia*] *fascicularis* (v. Drasche) was from the Philippines. It was from the Caroline Islands, and is not known from the Philippines, unless *Nephtheis thompsoni* (Herdman), 1886. should prove identical with von Drasche's species.

Hartmeyer (1909) in Bronn's Tier-reich has compiled a list of all the known species of ascidians with brief indications of their distribution in the various regions. He states (p. 1439) that he has received specimens of *Nephtheis* from Gould's type-locality (the Sulu Sea).

COLLECTION OF THE PHILIPPINE EXPEDITION, 1907–1910.

The ascidians collected by the *Albatross* Expedition and turned over to the writer for study comprise 163 lots of specimens, representing 46 species and, according to the classification here adopted, 29 genera and 12 families. Owing to the large number of species previously described from the Malay region, there could be little doubt that most of the forms had already been described, and the writer has been able to refer all but eight of them to species already known, although in identifying some of the less clearly characterized forms without an actual comparison of specimens an element of doubt could not be eliminated. Of the eight species which it has seemed necessary to treat as new to science, two are so distinct from any thus far described as to require the formation of a new genus for each. The others present no striking peculiarities.

The writer has also examined a few other specimens of Ascidians from the Philippines contained in the collections of the United States National Museum. No additional species were found among them, but their localities have been recorded in this paper.

The following are the species collected by the *Albatross* Expedition:

Family MOLGULIDAE Lacaze-Dulhiers, 1877.

1. ***Molgula vitrea*** Sluiter, 1904.

Family Tethyidae Huntsman, 1912 not Hartmeyer, 1908 and 1909 [Cynthiidae, Halocynthiidae s. Pyuridae Authors].

2. *Ctenyura intermedia*, new genus, new species.
3. *Pyura inflata*, new species.
4. *Pyura pallida* (Heller), 1878.
5. *Pyura duplicata*, new species.
6. *Microcosmus exasperatus* Heller, 1878.
7. *Culeolus herdmani* Sluiter, 1904. (Not collected in the Philippine region.)

Family Styelidae Sluiter, 1895 [=Tethyidae Hartmeyer, 1908-1909, and Van Name, 1912, not Huntsman, 1912].

8. *Styela areolata* Heller, 1878.
9. *Styela tinaktae*, new species.
10. *Styela macandria* Sluiter, 1904.
11. *Pandocia circumarata* (Sluiter), 1904.
12. *Pandocia aurata* (Quoy and Gaimard), 1834.
13. *Pandocia pedata* (Herdman), 1881.
14. *Pandocia quadrata* (Herdman), 1881.
15. *Pandocia ovata* (Pizon), 1908.
16. *Polyandrocarpa maxima* (Sluiter), 1904.
17. *Eusynstela latericius* (Sluiter), 1904.
18. *Stolonica stycliformis*, new species.
19. *Stolonica vesicularis*, new species.

Family Botryllidae Verrill, 1871.

20. *Botrylloides tyreum* Herdman, 1886.

Family Rhodosomatidae Hartmeyer, 1908.

21. *Rhodosoma papillosum* (Stimpson), 1855.

Family Phallusiidae Traustedt, 1882 [=Ascidiidae Authors].

22. *Phallusia depressiuscula* (Heller), 1878.
23. *Phallusia aperta* (Sluiter), 1904.

Family Perophoridae Giard, 1872.

24. *Perophora hutchisoni* MacDonald, 1859.

Family Cionidae Lahille, 1887.

25. *Ciallusia longa*, new genus, new species.

Family Diazonidae Garstang, 1891.

26. *Rhopalopsis crassa* (Herdman), 1880.

Family Clavelinidae Forbes, 1848 [=Clavelinidae+Polycitoridae s. Distomidea Authors].

27. *Clavelina molluccensis* (Sluiter), 1904.
28. *Clavelina detorta* (Sluiter), 1904.
29. *Polycitor ianthinus* Sluiter, 1909.
30. *Polycitor torosus* Sluiter, 1909.
31. *Cystodites philippinensis* Herdman, 1886.
32. *Holozoa vallii* (Herdman), 1886.
33. *Sycozoa pulchra* (Herdman), 1886.
34. *Nephtheis thompsoni* (Herdman), 1886.

Family DIDEMNIDAE Verrill, 1871.

35. *Didemnopsis jolense*, new species.
36. *Didemnum grande* (Herdman), 1886.
37. *Didemnum moseleyi* (Herdman), 1886.
38. *Didemnum ternatanum* (Gottschaldt), 1898.
39. *Polysyncraton dubium* Sluiter, 1909.
40. *Leptoclinum macdonaldi* (Herdman), 1886.
41. *Leptoclinum calificiforme* Sluiter, 1909.

Family SYNOICIDAE Hartmeyer, 1908 [=POLYCLINIDAE Authors].

42. *Polyclinum festum* Hartmeyer, 1905.
43. *Amaroucium crateriferum* Sluiter, 1909.
44. *Amaroucium multiplicatum* (Sluiter), 1909.
45. *Amaroucium constrictum* Sluiter, 1900.
46. *Aplidium depressum* Sluiter, 1909.

All the above species except the deep water *Culeolus herdmani* were collected at stations among the Philippine Islands. Although only eight are new species, a majority of them have not been previously recorded from the Philippines.

ADDITIONAL SPECIES COLLECTED BY OTHER EXPEDITIONS.

To arrive at the total number of forms known from the Philippines, the following list of species (25, with one very doubtfully valid variety) previously recorded, but not collected by the *Albatross* Expedition, must be added to the above 45. In order to avoid the necessity of repeating this list, the synonyms of the several species and the locality in the Philippines from which they have been reported are also given. Leaving Gould's doubtful and insufficiently characterized forms out of account, the species credited to the Philippines number 70, representing 36 genera and 12 families. Among these 70 species are doubtless some synonyms.

Family TETHYIDAE.

PYURA JACATRENSIS (Sluiter), 1890.

1890. *Cynthia jacatrensis* SLUITER, Nat. Tijds. Ned. Ind., vol. 50, p. 331.
1891. *Cynthia jacatrensis* HERDMAN, Journ. Linn. Soc. London, Zool., vol. 23, p. 576.
1904. *Halocynthia jacatrensis* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 47.
1909. *Pyura jacatrensis* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1340.

Pearl Bank, Sulu Archipelago, 15 meters. (Sluiter, 1904.)

CULEOLUS THYSANOTUS Sluiter, 1904.

1903. *Culeolus*, sp. WEBER, *Siboga*-Exped., vol. 1, p. 55, text-fig.
1904. *Culeolus thysanotus* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 106, pl. 2, fig. 1; pl. 12, figs. 10–13.
1909. *Culeolus thysanotus* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1347.

Lat. 5° 11.2′ N.; long. 119° 35.4′ E., 450 meters. (Sluiter, 1904.)

Family STYELIDAE.

PANDOCIA PROCERA (Sluiter), 1885.

1885. *Styela procera* SLUITER, Nat. Tijds. Ned. Ind., vol. 45, p. 196.
1891. *Polycarpa procera* HERDMAN, Journ. Linn. Soc. London, Zool., vol. 23, p. 584.
1904. *Styela procera* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 59.
1909. *Pandocia procera* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1364.

Pearl Bank, Sulu Archipelago, 15 meters. (Sluiter, 1904.)

PANDOCIA IRREGULARIS (Herdman).

1881. *Polycarpa irregularis* HERDMAN, Proc. Roy. Soc. Edinburgh, vol. 11, p. 72.
1882. *Polycarpa irregularis* HERDMAN, Rep. Voy. *Challenger*, vol. 6, Tunicata, p. 178, pl. 23, figs. 7 and 8.
1885. *Polycarpa irregularis* TRAUSTEDT, Vid. Meddel. Nat. For. Kjobenhavn. ann. 1884, p. 48.
1891. *Polycarpa irregularis* HERDMAN, Journ. Linn. Soc. London, Zool., vol. 23, p. 585.
1909. *Pandocia irregularis* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1363.

Lat. 11° 37′ N.; long. 123° 12′ E., 18 fathoms. (Herdman, 1886.)
This species may not be distinct from *P. pedata* (Herdman).

PANDOCIA THELYPHANES (Sluiter), 1904.

1904. *Styela thelyphanes* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 68, pl. 8, figs. 17–19.
1909. *Pandocia thelyphanes* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1364.

Sulu Archipelago, 14 meters. (Sluiter, 1904.)

DIANDROCARPA MONOCARPA, var. PHILIPPINENSIS Michaelsen, 1904.

1886. *Synstyela incrustans* (part) HERDMAN, Rep. Voy. *Challenger*, vol. 14, Tunicata, p. 342, pl. 46, figs. 9–14.
1891. *Synstyela incrustans* (part) HERDMAN, Journ. Linn. Soc. London, Zool., vol. 23, p. 637.
1904. *Diandrocarpa monocarpa*, var. *philippinensis* MICHAELSEN, Mitth. Naturhist Mus. Hamburg, vol. 21, suppl. 2, p. 48, pl. 1, fig. 5.
1909. *Diandrocarpa monocarpa*, var. *philippinensis* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1371.

Zamboanga, Philippines. (Herdman, 1886.)

Family BOTRYLLIDAE.

BOTRYLLOIDES PERSPICUUM Herdman, 1886.

1886. *Botrylloides perspicuum* HERDMAN, Rep. Voy. *Challenger*, vol. 14, Tunicata, p. 45, pl. 1, figs. 4–5; pl. 3, figs. 9–14.
1891. *Botrylloides perspicuum* HERDMAN, Journ. Linn. Soc. London, Zool., vol. 23, p. 608.

1900. *Botrylloides perspicuum* SLUITER, Zool. Jahrbücher, Syst., vol. 13, p. 21.
1904. *Botrylloides perspicuum* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 101.
1909. *Botrylloides perspicuum* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1380.

Lat. 6° 54′ N.; long. 122° 18′ E., 10 fathoms. (Herdman, 1886.)

BOTRYLLOIDES PERSPICUUM, var. RUBICUNDUM Herdman, 1886.

1886. *Botrylloides perspicuum*, var. *rubicundum* HERDMAN, Rep. Voy. *Challenger*, vol. 14, Tunicata, p. 48, pl. 1, figs. 6–7; pl. 3, figs. 15–18.
1891. *Botrylloides perspicuum*, var. *rubicundum* HERDMAN, Journ. Linn. Soc. London, Zool., vol. 23, p. 608.
1909. *Botrylloides perspicuum*, var. *rubicundum* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1380.

Lat. 6° 54′ N.; long. 122° 18′ E., 10 fathoms. (Herdman, 1886.)

This form seems to be only very doubtfully distinguishable, even as a variety, from the typical *B. perspicuum*.

Family RHODOSOMATIDAE.

CHELYOSOMA SIBOGAE Sluiter, 1904.

1904. *Chelyosoma sibogae* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 18, pl. 1, fig. 3; pl. 4, figs. 11–12.
1909. *Chelyosoma sibogae* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1392.
1911. *Chelyosoma sibogae* REDIKORZEW, Ann. Mus. Zool. Acad. Sci. St. Pétersbourg, vol. 16, p. 150.

Lat. 6° 8′ N.; long. 121° 19′ E., 275 meters. (Sluiter, 1904.)

Family PHALLUSIIDAE.

PHALLUSIA KREAGRA (Sluiter), 1895.

1895. *Ascidia kreagra* SLUITER, Denkschr. Med.-Nat. Gesell, Jena, vol. 8, p. 178, pl. 9, figs. 10–11.
1904. *Ascidia kreagra* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 29.
1909. *Phallusia kreagra* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1402.

Pearl Bank, Sulu Archipelago, 15 meters. (Sluiter, 1904.)

PHALLUSIA MELANOSTOMA (Sluiter), 1885.

1885. *Ascidia melanostoma* SLUITER, Nat. Tijds. Ned. Ind., vol. 45, p. 172.
1890. *Ascidia melanostoma* SLUITER, Nat. Tijds. Ned. Ind., vol. 50, p. 342.
1891. *Ascidia melanostoma* HERDMAN, Jour. Linn. Soc. London, Zool., vol. 23, p. 592.
1909. *Phallusia melanostoma* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1402.

Pearl Bank, Sulu Archipelago, 15 meters. (Sluiter, 1904.)

Family PEROPHORIDAE.

ECTEINASCIDIA DIAPHANIS Sluiter, 1885.

1885. *Ecteinascidia diaphanis* SLUITER, Nat. Tijds. Ned. Ind., vol. 45, p. 168.
1890. *Ecteinascidia diaphanis* SLUITER, Nat. Tijds. Ned. Ind., vol. 50, p. 348.
1891. *Ecteinascidia diaphanis* HERDMAN, Journ. Linn. Soc. London, Zool., vol. 23, p. 602.
1904. *Ecteinascidia diaphanis* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 10.
1909. *Ecteinascidia diaphanis* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1411.

Pearl Bank, Sulu Archipelago, 15 meters; lat. 5° 48.7′ N.; long. 119° 49.6′ E., 564 meters; lat. 6° 10.3′ N.; long. 121° 32′ E., 13 meters. (Sluiter, 1904.)

ECTEINASCIDIA GARSTANGI Sluiter, 1897.

1897. *Ecteinascidia garstangi* SLUITER, Zool. Jahrbücher, Syst., vol 11, p. 10.
1904. *Estcinascidia garstangi* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 10.
1909. *Ecteinascidia garstangi* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1412.

Pearl Bank, Sulu Archipelago, 15 meters. (Sluiter, 1904.)

Family CLAVELINIDAE.

POLYCITOR DISCOLOR Sluiter, 1909.

1909. *Polycitor discolor* SLUITER, *Siboga*-Exped., vol. 56*b*, p. 17, pl. 1, fig. 18.
1909. *Eudistoma discolor* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1488.

Lat. 6° 7.5′ N.; long. 120° 26′ E., 16–23 meters. (Sluiter, 1909.)

POLYCITOR SEDENS (Sluiter), 1909.

1909. *Sycozoa sedens* SLUITER, *Siboga*-Exped., vol. 56*b*, p. 34, pl. 3, figs. 5–7; pl. 7, fig. 1.
1909. *Eudistoma sedens* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1488.

Sanguisiapo, Sulu Archipelago, reef. (Sluiter, 1909.)

CYSTODITES RUFUS Sluiter, 1909.

1909. *Cystodites rufus* SLUITER, *Siboga*-Exped., vol. 56*b*, p. 29.
1909. *Cystodites rufus* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1488.

Sulu Island, 14 meters. (Sluiter, 1909.)

CYSTODITES SEMICATAPHRACTUS Sluiter, 1909.

1909. *Cystodites semicataphractus* SLUITER, *Siboga*-Exped., vol. 56*b*, p. 30.
1909. *Cystodites semicataphractus* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1488.

Lat. 6° 7.5′ N.; long. 120° 26′ E., 16–23 meters. (Sluiter, 1909.)

Family DIDEMNIDAE.

TRIDIDEMNUM GRANOSUM Sluiter, 1909.

1909. *Tridídemnum granosum* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 41, pl. 3, fig. 11; pl. 7, figs. 5–6.

Pulu Sanguisiapo, Sulu Archipelago, 12 meters. (Sluiter, 1909.)

DIDEMNUM DIGESTUM Sluiter, 1909.

1909. *Didemnum digestum* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 54, pl. 3, fig. 24; pl. 6, fig. 10.

Lat. 6° 7.5′ N.; long. 120° 26′ E., 16–23 meters. (Sluiter, 1909.)

DIDEMNUM MAKROPNOUS Sluiter, 1909.

1909. *Didemnum makropnous* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 56.

Lat. 6° 7.5′ N.; long. 120° 26′ E., 16–23 meters. (Sluiter, 1909.)

DIDEMNUM RAMOSUM Sluiter, 1909.

1909. *Didemnum ramosum* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 63.

Lat. 6° 7.5′ N.; long. 120° 26′ E., 16–23 meters. (Sluiter, 1909.)

DIPLOSOMOIDES MOLLE Herdman, 1886.

1886. *Diplosomoides molle* Herdman, Rep. Voy. *Challenger*, vol. 14. Tunicata, p. 310, pl. 42, figs. 5–16.
1891. *Diplosomoides molle* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 630.
1909. *Diplosomoides molle* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 85.
1909. *Diplosomoides molle* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1456.

Sulu Archipelago, 13 meters. (Sluiter, 1909).

Family SYNOICIDAE.

POLYCLINUM MIKROPNOUS Sluiter, 1909.

1909. *Polyclinum mikropnous* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 94, pl. 5, fig. 1.
1909. *Polyclinum mikropnous* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1461.

Lat. 6° 7.5′ N.; long. 120° 26′ E., 16–23 meters. (Sluiter, 1909.)

APLIDIUM FUMIGATUM Herdman, 1886.

1886. *Aplidium fumigatum* Herdman, Rep. Voy. *Challenger*, vol. 14. Tunicata, p. 211, pl. 26, figs. 8, 9.
1909. *Aplidium fumigatum* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 622.
1909. *Aplidium fumigatum* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1469.

Zebu, Philippines. (Herdman, 1886.)

ATOPOGASTER TROPICA Sluiter, 1909.

1909. *Atopogaster tropicum* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 107, pl. 5, fig. 10; pl. 7, fig. 15.
1909. *Atopogaster tropica* Herdman, Bronn's Tier-reich, vol. 3, suppl., p. 1465.

Kapul Island, Sulu Archipelago, 13 meters (Sluiter, 1909).

SYNOICUM INTERCEDENS (Sluiter), 1909.

1909. *Morchellium intercedens* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 108, pl. 5, fig. 11.
1909. *Synoicum intercedens* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1476.

Sulu Archipelago (Sluiter, 1909).

Although a majority of the Malayan ascidians are probably widely distributed in that region and may sooner or later be found to occur in Philippine waters, at least in the Sulu Archipelago, the following additional species (13 in number) were obtained by the *Siboga* Expedition at points such a short distance south of the Philippine group that there is little doubt that they will eventually be found within its limits.

Botryllus separatus Sluiter, 1909, Muaras Reef (off the east coast of Borneo).
Corella aequabilis Sluiter, 1904, Karkaralong Group and Karekelang Island.
Sluiteria rubricollis (Sluiter), 1904, Karkaralong Group.
Eetcinascidia nexa Sluiter, 1904, Karkaralong Group.
Polycitor violaceus Sluiter, 1909, Karekelang Island.
Polycitor multiperforatus Sluiter, 1909, Muaras Reef.
Trididemnum planum Sluiter, 1909, Muaras Reef.
Didemnum tabulatum Sluiter, 1909, Karkaralong Group.
Didemnum fragile, Sluiter, 1909, Karkaralong Group.
Didemnum reticulatum Sluiter, 1909, Karkaralong Group.
Didemnum maeandrium Sluiter, 1909, Karekelang Island.
Leptoclinum multifidum Sluiter, 1909, Muaras Reef.
Diplosomoides tropicum Sluiter, 1909, Karkaralong Group and Muaras Reef.

DISTRIBUTION OF THE SPECIES IN DEPTH AND GEOGRAPHICAL AREA.

Ascidians were obtained by the *Albatross* Expedition at 53 stations in the Philippine region and at 3 outside (to the south) of it. The total number of numbered dredging stations of the expedition was 576, but collecting was done also at many other stations not numbered. Although much dredging in deep and moderately deep water was done by the expedition, it is worthy of note that few ascidians were obtained at greater depths than about 30 fathoms. The eight stations

where ascidians were obtained at depths of over 40 fathoms and the species collected (10 in all) are as follows:

D5153,[1] 49 fathoms:
Ciallusia longa, new species.
D5166, 97 fathoms:
Pyura inflata, new species.
D5168, 80 fathoms:
Rhopalopsis crassa (Herdman).
Polycitor torosus Sluiter.
D5432, 51 fathoms:
Ciallusia longa, new species.
D5518, 200 fathoms:
Clavelina molluccensis (Sluiter).
D5536, 279 fathoms:
Molgula vitrea (Sluiter).
Ctenyura intermedia, new species.
Pyura pallida (Sluiter).
Pandocia quadrata (Herdman).
D5608, 1,089 fathoms:
Molgula vitrea (Sluiter).
D5623, 272 fathoms:
Culeolus herdmani Sluiter.

Of these 10 species the only ones not also obtained at stations in depths of less than 50 fathoms are:

Molgula vitrea (Sluiter).
Ctenyura intermedia, new species.
Pyura inflata, new species.
Culeolus herdmani Sluiter.
Pandocia quadrata (Herdman).

The geographical distribution of the ascidians in the different parts of the Philippines must be very unequal if the results of this expedition are conclusive. To what extent this may be due to the circumstances, methods, and accidents of collecting, rather than to uneven distribution of the animals, is difficult to say, but there can be little doubt that both of these factors must be taken into account.

Of all the stations where ascidians were collected only five lie to the northward of the twelfth parallel of latitude, which crosses near the middle of the Philippine group. The most favorable localities were in the Sulu Archipelago, especially about Jolo Island, and among the Tawi Tawi group. The stations in the vicinity of Jolo Light yielded the greatest number of species, no less than 30 being obtained within a small radius of the light. The most favorable stations were as follows:

D5145, 14 species.
D5174, 12 species.
D5139, D5144, D5149, 8 species each.

[1] See list of stations pp. 61–67.

All these five stations were in shallow water in the Sulu Archipelago, the first four of them near Jolo. The great abundance and variety of ascidians in the Sulu Archipelago is also proved by the results of the *Siboga* Expedition, which found several localities there where a number of forms were collected, although the collecting stations of that expedition in the archipelago were few in number. This does not of course prove that equally favorable localities may not exist in the more northern parts of the Philippine group, but if so they have not yet been found.

A list of stations where ascidians were obtained by the *Albatross* expedition with the species collected at each is here given. Full details in regard to these stations are given in the Dredging and Hydrographic Records of the U. S. Fisheries steamer *Albatross* during the Philippine expedition, 1907–1910 (Bureau of Fisheries Document, No. 741, Washington, D. C., 1910).

CHINA SEA OFF SOUTHERN LUZON.

D5108, Corregidor Light N. 39° E., 22.50 miles (14° 05′ 5″ N.; 120° 19′ 45″ E.), January 15, 1908, 13 fathoms, coral.
Rhopalopsis crassa (Herdman).
Cystodites philippinensis Herdman.

D5109, Corregidor Light N. 42° E., 25.80 miles (14° 03′ 45″ N.; 120° 16′ 30″ E.), January 15, 1908, 10 fathoms, coral.
Polysyncraton dubium Sluiter (doubtful specimen).
Aplidium depressum Sluiter.

SULU SEA, VICINITY SOUTHERN PANAY.

D5128, Nogas Island (W. tangent) N. 6° E., 32.50 miles (9° 52′ 10″ N.; 121° 49′ 35″ E.), February 4, 1908, surf.
Didemnum grande (Herdman).

SULU ARCHIPELAGO NEAR BASILAN ISLAND.

D5134, Balukbaluk Island (N. tangent) S. 59° W., 6.25 miles (6° 44′ 45″ N.; 121° 48′ E.), February 7, 1908, 25 fathoms, fine sand.
Stolonica styeliformis, new species.

VICINITY OF JOLO.

(See also stations D5174, D5555, and D5557, in the near vicinity of this island.)

Marongas Island, S. side, February 10, 1908, 4–8 feet, coral.
Didemnum ternatanum (Gottschaldt).
Leptoclinum calificiforme Sluiter.

Jolo, Jolo Island, February 11, 1908 (no further data).
Eusynstyela latericius (Sluiter).
Cystodites philippinensis Herdman.
Didemnum ternatanum (Gottschaldt).
Amaroucium crateriferum Sluiter.

D5136, Jolo Light S. 37° E., 0.70 mile (6° 04′ 20″ N.; 120° 59′ 20″ E.), February 14, 1908, 22 fathoms, sand and shells.

Microcosmus exasperatus Heller.
Stolonica styeliformis, new species.
Nephtheis thompsoni (Herdman). Doubtful specimen.
Didemnum grande (Herdman).
Didemnum ternatanum (Gottschaldt).
Polysyncraton dubium Sluiter.

D5137, Jolo Light S. 61° E., 1.30 miles (6° 04′ 25″ N.; 120° 58′ 50″ E.), February 14, 1908, 10 fathoms, sand and coral.

Rhodosoma papillosum (Stimpson).
Didemnopsis jolense, new species.

D5139 Jolo Light S. 51° W., 3.60 miles (6° 06′ N.; 121° 02′ 30″ E.), February 14, 1908, 20 fathoms, coral sand.

Rhodosoma papillosum (Stimpson).
Clavelina detorta (Sluiter).
Polycitor ianthinus Sluiter.
Holozoa vallii (Herdman).
Nephtheis thompsoni (Herdman).
Didemnum grande (Herdman).
Didemnum ternatanum (Gottschaldt).
Polysyncraton dubium Sluiter.

D5141, Jolo Light S. 17° E., 5.50 miles (6° 09′ N.; 120° 58′ E.), February 15, 1908, 29 fathoms, coral sand.

Polyandrocarpa maxima (Sluiter).
Phallusia depressiuscula (Heller).
Rhopalopsis crassa (Herdman).
Cystodites philippinensis Herdman.
Holozoa vallii (Herdman).
Amaroucium multiplicatum (Sluiter).

D 5144, Jolo Light S. 50° W., 3.40 miles (6° 05′ 50″ N.; 121° 02′ 15″ E.), February 15, 1908, 19 fathoms, coral sand.

Styela macandria Sluiter.
Pandocia circumarata (Sluiter).
Pandocia ovata (Pizon).
Botrylloides tyreum Herdman.
Phallusia depressiuscula (Heller).
Clavelina molluccensis (Sluiter).
Didemnum ternatanum (Gottschaldt).
Amaroucium crateriferum Sluiter.

D5145, Jolo Light S. 16° E., 0.85 mile (6° 04′ 30″ N.; 120° 59′ 30″ E.), February 15, 1908, 23 fathoms, coral sand and shells.

Microcosmus exasperatus Heller.
Styela tinaktae, new species.
Stolonica vesicularis, new species.
Rhodosoma papillosum (Stimpson).
Clavelina molluccensis (Sluiter).
Clavelina detorta (Sluiter).
Polycitor ianthinus Sluiter.
Nephtheis thompsoni (Herdman).
Didemnum grande (Herdman).
Didemnum moselcyi (Herdman).
Polysyncraton dubium Sluiter.

Leptoclinum macdonaldi (Herdman).
Amaroucium crateriferum Sluiter.
Amaroucium multiplicatum (Sluiter).

SULU ARCHIPELAGO, VICINITY OF SIASI.

D5146, Sulade Island (E. tangent) N. 18° W., 3.40 miles (5° 46′ 40″ N.; 120° 48′ 50″ E.), February 16, 1908, 24 fathoms, coral sand and shells.
Pandocia pedata (Herdman).
Botrylloides tyreum Herdman.

D5147, Sulade Island (E. tangent) N. 30° E., 8.40 miles (5° 41′ 40″ N.; 120° 47′ 10″ E.), February 16, 1908, 21 fathoms, coral sand and shells.
Pyura pallida (Heller).
Microcosmus exasperatus Heller.
Styela arcolata Heller.
Phallusia depressiuscula (Heller).
Phallusia aperta Sluiter.
Holozoa vallii (Herdman).
Didemnum grande (Herdman).

D5148, Sirun Island (N. tangent) S. 80° W., 3.90 miles (5° 41′ 40″ N.; 120° 47′ 30″ E.), 17 fathoms, coral sand.
Holozoa vallii Herdman.
Didemnum grande (Herdman).
Leptoclinum macdonaldi (Herdman).

D5149, Sirun Island (W. tangent) N. 39° E., 2.40 miles (5° 33′ N.; 120° 42′ 10″ E.), February 18, 1908, 10 fathoms, coral and shells.
Pyura pallida (Heller).
Pandocia ovata (Pizon).
Cystodites philippinensis Herdman.
Holozoa vallii (Herdman).
Sycozoa pulchra (Herdman).
Nephtheis thompsoni (Herdman).
Didemnum grande (Herdman).
Didemnum ternatanum (Gottschaldt).

D5150, Sirun Island (W. tangent) N. 34° E., 11.7 miles (5° 23′ 20″ N.; 120° 35′ 45″ E.), February 18, 1908, 21 fathoms, coral sand and shells.
Didemnum grande (Herdman).
Polysyncraton dubium Sluiter.

SULU ARCHIPELAGO, TAWI TAWI GROUP.

D5151, Sirun Island (C.) N. 58° E., 19.3 miles (5° 24′ 40″ N.; 120° 27′ 15″ E.), February 18, 1908, 34 fathoms, white sand.
Pyura pallida (Heller).

D5153, Tocanni Point S. 27° E., 2.10 miles (5° 18′ 10″ N.; 120° 02′ 55″ E.), February 19, 1908, 49 fathoms, coral sand and shells.
Ciallusia longa, new species.

D5154, Bakun Point S. 11° W., 0.70 mile (5° 14′ 50″ N.; 119° 58′ 45″ E.), February 19, 1908, 12 fathoms, coral sand.
Didemnum grande (Herdman).
Didemnum ternatanum (Gottschaldt).

D5156, Tinakta Island (N. tangent) S. 77° W., 3.40 miles (5° 12′ 50″ N.; 119° 55′ 55″ E.), February 21, 1908, 18 fathoms, fine sand and shells.
Pandocia aurata (Quoy and Gaimard).

D5158, Tinakta Island (N. tangent) N. 89° W., 1.90 miles (5° 12′ N.; 119° 54′ 30″ E.), February 21, 1908, 12 fathoms, coarse sand and shells.
Pandocia pedata (Herdman).

D5159, Tinakta Island (N. tangent) N. 82° W., 1.40 miles (5° 11′ 50″ N.; 119° 54′ E.), February 21, 1908, 10 fathoms, coral sand.
Styela tinaktae, new species.
Rhopalopsis crassa (Herdman).

D5160, Tinakta Island (N. tangent) S. 72° W., 2.75 miles (5° 12′ 40″ N.; 119° 55′ 10″ E.), February 22, 1908, 12 fathoms, sand.
Polycitor ianthinus Sluiter.

D5163, Observation Island N. 79° W., 6.70 miles (4° 59′ 10″ N.; 119° 51′ E.), February 24, 1908, 28 fathoms, coral sand.
Pyura pallida (Heller).
Styela arcolata Heller.
Rhodosoma papillosum (Stimpson).
Phallusia depressiuscula (Heller).
Polycitor torosus Sluiter.

D5164, Observation Island S. 82° W., 8 miles (5° 01′ 40″ N.; 119° 52′ 20″ E.), February 24, 1908, 18 fathoms, green mud.
Pandocia pedata (Herdman).
Clavelina molluccensis (Sluiter).

D5165, Observation Island N. 70° W., 6.40 miles (4° 58′ 20″ N.; 119° 50′ 30″ E.), February 24, 1908, 9 fathoms, coral.
Nephthcis thompsoni (Herdman).
Didemnum ternatanum (Gottschaldt).

D5166, Observation Island N. 20° W., 4.60 miles (4° 56′ 10″ N.; 119° 46′ E.), February 24, 1908, 97 fathoms, coral sand.
Pyura inflata, new species.

D5168, Observation Island N. 17° W., 4.20 miles (4° 56′ 30″ N.; 119° 45′ 40″ E.), February 25, 1908, 80 fathoms, coral sand.
Rhopalopsis crassa (Herdman).
Polycitor torosus Sluiter.

SULU ARCHIPELAGO, VICINITY OF SIBUTU ISLAND.

Tumindao Reef, S. end February 26, 1908, 9–15 feet (dynamite).
Pandocia aurata (Quoy and Gaimard).
Pandocia pedata (Herdman).

VICINITY OF JOLO.

(See also stations at Marongas Island, Jolo, D5136, D5137, D5139, D5143, D5145, D5555, and D5557 in the vicinity of Jolo.)

D5174, Jolo Light E. 2.60 miles (6° 03′ 45″ N.; 120° 51′ E.), March 5, 1908, 20 fathoms, coarse sand.
Pyura pallida (Heller).
Pandocia circumarata (Slulter).
Stolonica styliformis, new species.
Phallusia depressiuscula (Heller).
Rhopalopsis crassa (Herdman).
Clavelina molluccensis (Sluiter).
Cystodites philippinensis Herdman.
Didemnum moseleyi (Herdman).
Polysyncraton dubium Sluiter.

Polyclinum festum Hartmeyer.
Amaroucium crateriferum Sluiter.
Amaroucium constrictum Sluiter.

VICINITY OF WESTERN BOHOL.

Mantacao Island, S. side (reef), April 8, 1908, 10–30 feet (dynamite).
Didemnum ternatanum (Gottchaldt).

OFF WESTERN SAMAR.

Catbalogan (Pamuntangan Reef), April 14, 1908, 12–15 feet (dynamite).
Pyura pallida Heller.
Catbalogan (reef), April 15, 1908 (dynamite).
Phallusia depressiuicula (Heller).
Catbalogan (reef), April 16, 1908 (dynamite).
Pyura pallida (Heller).
Pyura duplicata, new species.
Phallusia depressiuscula (Heller).

BETWEEN BURIAS AND LUZON.

D5218, Anima Sola Island (E. tangent) N. 10° W., 2 miles (13° 11′ 15″ N.; 123° 02′ 45″ E.), April 22, 1908, 20 fathoms, coarse sand.
Pandocia pedata (Herdman).
Didemnum ternatanum (Gottschaldt).

PACIFIC OCEAN, EAST COAST MINDANAO.

Surigao (reef above Bilan Bilan), May 8, 1908, 6 to 15 feet (dynamite).
Pandocia aurata (Quoy and Gaimard).
Didemnum ternatanum (Gottschaldt).

GULF OF DAVAO.

D5250, Linao Point N. 22° E., 1.1 miles (7° 05′ 07″ N.; 125° 39′ 45″ E.), May 18, 1908, 23 fathoms, coral sand.
Pandocia pedata (Herdman).
Rhodosoma papillosum (Stimpson).
Didemnopsis jolense, new species.
D5251, Linao Point N. 32° E., 1.1 miles (7° 05′ 12″ N.; 125° 39′ 35″ E.), May 18, 1908, 20 fathoms, coral.
Pandocia pedata (Herdman).
D5253, Linao Point N. 22° E.; 1.5 miles (7° 04′ 48″ N.; 125° 39′ 38″ E.), May 18, 1908, 28 fathoms, coral.
Pandocia pedata (Herdman).
D5254, Linao Point N. 44° E., 0.7 mile (7° 05′ 42″ N.; 125° 39′ 42″ E.), May 18, 1908, 21 fathoms, sand and coral.
Pandocia aurata (Quoy and Gaimard).
Phallusia depressiuscula (Heller).

OFF SOUTHEASTERN MINDORO.

Mansalay, Mindoro (reef), June 4, 1908, 5–15 feet (dynamite).
Pandocia aurata (Quoy and Gaimard).

MALAMPAYA SOUND, PALAWAN ISLAND.

Endeavor Point, December 24, 1908.
Phallusia depressiuscula (Heller).

ULUGAN BAY, PALAWAN ISLAND.

Ulugan Bay, December 29, 1908.
Phallusia depressiuscula (Heller).
Didemnum ternatanum (Gottschaldt).

MANILA BAY.

D5360, Corregidor Light S. 74° W., 6.9 miles (14° 21′ N.; 120° 41′ E.), February 7, 1909, 12 fathoms.
Phallusia depressiuscula (Heller).

NORTH OF CEBU.

D5401, Tanguingui Island Light N. 79° W., 23 miles (11° 24′ 45″ N.; 124° 06′ E., March 16, 1909, 30 fathoms, fine sand.
Clavelina molluccensis (Sluiter).

EASTERN PALAWAN AND VICINITY.

D5432, Corandagos Island (NW. tangent) N. 28° E., 4.8 miles (10° 38′ 45″ N.; 120° 12′ 45″ E.), April 8, 1909, 51 fathoms, sand.
Ciallusia longa, new species.

NORTHERN MINDANAO AND VICINITY.

D5518, Point Tagolo Light (Mindanao) S. 64° W., 8.7 miles (8° 48′ N.; 123° 31′ E.), August 9, 1909, 200 fathoms, gray mud and Globigerina.
Clavelina molluccensis (Sluiter).

BETWEEN NEGROS AND SIQUIJOR.

D5536, Apo Island (C.) S. 26° W., 11.8 miles (9° 15′ 45″ N.; 123° 22′ E.), August 19, 1909, 279 fathoms, green mud and sand.
Molgula vitrea Sluiter.
Ctenyura intermedia, new species.
Pyura pallida (Herdman).

JOLO ISLAND AND VICINITY.

(See also stations at Marongas Island, Jolo, D5136, D5137, D5139, D5141, D5143, D5145, D5174, all in the vicinity of this island.)
D5555 Cabalian Point (Jolo) N. 50° W., 3.3 miles (5° 51′ 15″ N.; 129° 58′ 35″ E.), September 18, 1909, 34 fathoms, coarse sand.
Pyura pallida (Heller).
Stolonica styeliformis, new species.
Phallusia depressiuscula (Heller).
Rhopalopsis crassa (Herdman).
Polysyncraton dubium Sluiter.
Aplidium depressum Sluiter.
D5557, Cabalian Point (Jolo) N. 70° W., 5.2 miles (5° 51′ 30″ N.; 121° 01′ E.), September 18, 1908, 13 fathoms, sand and coral.
Eusynstyela latericius (Sluiter).

OFF ZAMBOANGA, MINDANAO.

D5597, Zamboanga Light N. 31° W., 0.1 mile (6° 54′ N.; 122° 04′ 30″ E.), October 12, 1909, 9 fathoms.
Perophora hutchisoni MacDonald.
Didemnum ternatanum (Gottschaldt).

The following three stations lie outside the limits of the Philippine region:

GULF OF TOMINI, CELEBES.

D5608, Binang Unang Island peak S. 87° E., 19 miles (0° 08′ S.; 121° 19′ E.), November 18, 1908, 1,089 fathoms, gray mud.
Molgula vitrea Sluiter.

BETWEEN GILLOLO AND MAKYAN ISLAND.

D5623, Makyan Island (S. tangent) S. 88° W., 7.5 miles (0° 16′ 30″ N.; 19′ E.), November 18, 1909, 1,089 fathoms, gray mud.
Molgula vitrea Sluiter.

BUTON STRAIT.

D5640, Labuan Blanda Island N. 88° E., 1 mile (4° 27′ S.; 122° 55′ 40″ E.), December 13, 1909, 24 fathoms, sand and broken shells.
Pandocia pedata (Herdman).

DESCRIPTIONS OF SPECIES.

The attention of the reader is called to the following notes of general application to the descriptions that follow:

If not otherwise stated the colors and appearance described are those of alcoholic specimens, and must naturally differ more or less from those of living or fresh examples, but no notes on the latter were given to the writer, and probably none were made.

Except when but one specimen was obtained the descriptions and anatomical figures must be understood as composites based on the study of different individuals, since it is only rarely that all the important details can be distinguished in one and the same individual owing to the contracted and fragile condition of the delicate structures and organs. Type-specimens have been designated for the new species. In order to avoid any possible misunderstanding it may be worth while to state that where specimens have been referred to species previously described, the descriptions and figures here given have in no case been based partly on the descriptions of the other authors, and partly on the *Albatross* specimens, but wholly on the latter.

As the system of classification and nomenclature used and fully explained by Hartmeyer (1909) in Bronn's Tier-reich, vol. 3, Supplement, has been quite closely followed (adopting, however, the modifications shown to be necessary in the work of Huntsman, 1912), it

has not seemed necessary to give family and generic diagnoses in the present paper. For these the reader is referred to the above work of Hartmeyer. Any material deviations from his system are explained.

In giving the number of internal longitudinal vessels in the branchial sac of simple ascidians the total number, including those on both sides of the folds, has been given, not the number on the exposed side only, as some writers have done.

The illustrations are from photographs and drawings by the writer. The drawings have been made more or less diagrammatic.

Abbreviations used in the text figures.

at, atrial aperture.
br, branchial aperture.
c, caecum.
fp, faecal pellet.
g, gonad.
i, intestine.
inc, incubatory pouch.
k, kidney.
l, liver.
mp, muscular process.
od, oviduct.
r, rectum.
sd, sperm duct.
st, stomach.

Family MOLGULIDAE Lacaze-Duthiers, 1877.

[=CAESIRIDAE Hartmeyer, 1908.]

Genus MOLGULA Forbes and Hanley 1848. [=CAESIRA Fleming, 1822.]

MOLGULA VITREA Sluiter, 1904.

1904. *Molgula vitrea* Sluiter, Tunicaten der *Siboga*-Expedition, pt. 1, p. 119, pl. 14, figs. 17–19.
1909. *Caesira vitrea* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1324.

Body oval, somewhat compressed laterally, anchored or lightly attached at the smaller end by a tuft of rootlike hairs; apertures at or near the opposite (or free) end, the branchial only moderately prominent in the contracted specimens, the atrial on a rather large tube of moderate length. The apertures are well separated, the branchial with 6, the atrial with 4 small pointed lobes. Test only moderately thick, transparent, gelatinous and colorless in formalin specimens, its surface much wrinkled and sparingly and unevenly covered with short stout crooked somewhat branched hairs to which mud adheres. A greater development of these hairs on the ventral region forms the tuft already mentioned by which the animal is attached. In the soft collapsed condition of the specimens accurate measurements are impossible. Size of largest individual about 20 mm. by 12 mm.

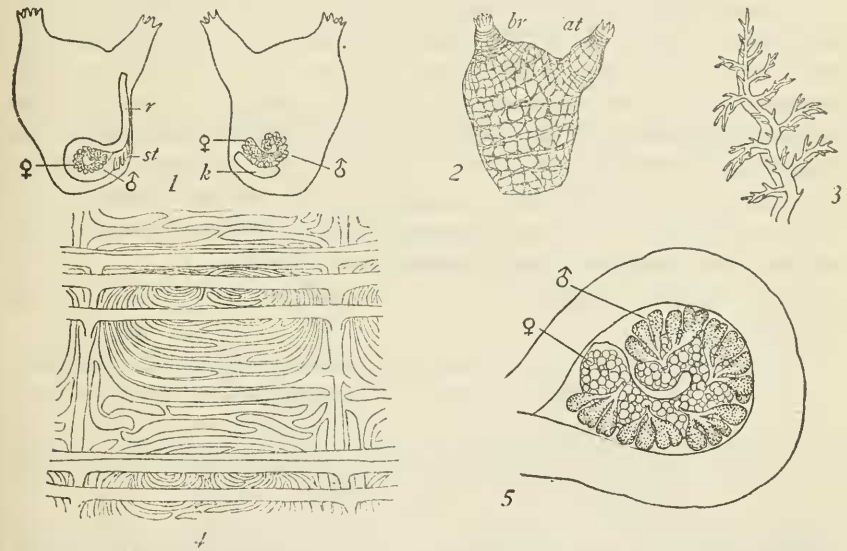
Mantle musculature of characteristic and conspicuous type, consisting of broad rather crooked bands, longitudinal and transverse ones predominating, but these anastomose, branch, and are accompanied by so many oblique and irregular ones that a conspicuous network with coarse squarish or oval meshes is formed.

There are about 20 tentacles of the first and second orders, with a few additional third-order tentacles. The large ones are two or three times compound; small branches few and rather slender, with tapering ends. Membranes borne on tentacles rather narrow.

Dorsal tubercle (seen in one specimen only) spindle shaped, with a large longitudinally elongated oval orifice.

Dorsal lamina plain-edged, at least on the anterior part.

Only six branchial folds were certainly demonstrated on each side, but owing to the poor preservation of the sac there may be seven (the number given by Sluiter for this species). On most parts of the sac at least, there is a single large infundibulum on each fold



FIGS. 1–5.—MOLGULA VITREA SLUITER. 1, LEFT AND RIGHT SIDES OF BODY. × 2. 2, NETWORK OF MUSCLE BANDS ON MANTLE. ×2. 3, TENTACLE. × 15. 4, PART OF BRANCHIAL SAC. × 20. 5, LEFT GONAD AND OUTLINE OF INTESTINAL LOOP. SEEN FROM SIDE NEXT TO BRANCHIAL SAC. × 10. (FOR LETTERING SEE PAGE 68.)

in the space between adjacent transverse vessels. It would perhaps better describe the condition to say that the folds each consist of a row of such infundibula. Stigmata long and narrow, arranged on these infundibula in quite regular spirals. Sometimes at least they form double spirals approaching the condition found in the genus *Eugyra*, but less regular, and occasionally interrupted. Some of the infundibula show a tendency to divide into an anterior and a posterior apex. On the intervals between folds the stigmata are also long and often form curves, hooks, and occasionally incipient spirals. A few delicate radial vessels cross the stigmata. Internal longitudinal vessels rather broad and quite thin. They are confined to the folds; eight or nine on a fold were counted in some cases, but this number is probably exceeded on the higher folds.

Digestive tract forming a small, short, but proportionately broad loop. Stomach elongated, of small diameter; a part of its wall is thrown into somewhat irregular glandular folds of a greenish color. Rectum long; margin of anus thin, not distinctly lobed.

Kidney small, sausage-shaped, and considerably curved with the concavity dorsal; attached to the mantle on the posterior ventral part of the right side.

A gonad is present on each side, that on the left side within the intestinal loop, that on the right just dorsal to the kidney. Gonads each consisting of an elongate ovary which is curved in a spiral of more than a complete turn, bordered and overlapped along its outer margin by the numerous small testes, the latter often cleft into two or three lobes. The free end of the ovary is not produced into an oviduct. The sperm ducts extend from the testes toward the center of the spiral formed by the ovary; they lie upon the free surface of the latter. The individual ducts end near the center of the gonad, often after uniting with the ducts of several adjacent testes. The structure of the gonad evidently resembles that described as characteristic of the genus *Gamaster* Pizon, 1896, but in that genus the branchial folds and the left gonad are wanting.

This is a deep-water form collected only at the two following stations:

No. 54.[1] Station D5536 (between Negros and Siquijor, N. lat. 9° 15′ 45″; E. long. 123° 22′, 279 fathoms, green mud, August 19, 1909). Two specimens. (Cat. No. 5921, U.S.N.M.)

No. 60. Station D5608 (Gulf of Tomini, Celebes, S. lat. 0° 08′; E. long. 121° 19′; 1,089 fathoms, gray mud, November 16, 1909). Three specimens. (Cat. No. 5920, U.S.N.M.)

The writer feels no hesitation in identifying these specimens with Sluiter's species, described from latitude 5° 26′ 36″ S.; longitude 132° 32′ 30″ E., 397 meters. *Molgula pellucida* MacDonald (1859*c*, p. 369, pl. 64, div. III, figs. 1–4) from Shark Bay, Australia, agrees with the present species in many characters external and internal, but, judging from his figures, the ovaries have a stout, flask-shaped outline instead of the tubular spirally curved form of the present species. *Molgula japonica* Hartmeyer, 1906, from Japan also agrees with the present species in many characters, including the position of the left gonad, but the gonads are described as long and club-shaped, and the intestine forms a long open loop.

Family TETHYIDAE Huntsman, 1912.

[CYNTHIIDAE, HALOCYNTHIIDAE, s. PYURIDAE Authors.]

Not Tethyidae Hartmeyer, 1908 and 1909 (=Styelidae of this paper).

[1] Number of the specimen or lot.

For the reasons rendering necessary shifting of the names *Tethyum* and Tethyidae see Huntsman, 1912.

The definition of the family as given by Hartmeyer will need to be made somewhat broader to accommodate the following genus.

CTENYURA, new genus.

Differs from *Pyura* Molina, 1810, in having reproductive organs on the right side only. These consist of small oval masses containing both eggs and testes arranged along a common oviduct (probably accompanied by a common sperm duct) with which they communicate by short branches. Along the summit of each fold the wall of the branchial sac is raised to small infundibula upon which the stigmata exhibit a spiral arrangement. This last character is unique in this family with the single exception of the Japanese species *Pyura comma* (Hartmeyer), 1906, in which the branchial sac is similar to that of the present genus. *P. comma*, however, has gonads on both sides of the body, as is characteristic of *Pyura*.

A branchial sac with infundibula and spiral stigmata closely resembling those of the Molgulidae combined with the general characters of the genus *Pyura* would seem to indicate a connecting form between the families Molgulidae and Tethyidae [Cynthiidae], from which the Molgulidae are in all probability directly descended, and would seem also at first sight to break down much of the distinction between the two families and justify uniting them. There is, however, the possibility that the resemblances in the branchial sac are due to convergence rather than common descent; in support of this it may be urged that neither the present genus nor Hartmeyer's species appear to approach the Molgulidae in their remaining characters any more closely than their allies which have no infundibula.

The name given this genus is, in accordance with its intermediate characters, a compound of parts of the names *Ctenicella*, a genus of Molgulidae, and *Pyura*, of the present family.

Type of the genus.—Ctenyura intermedia, new species.

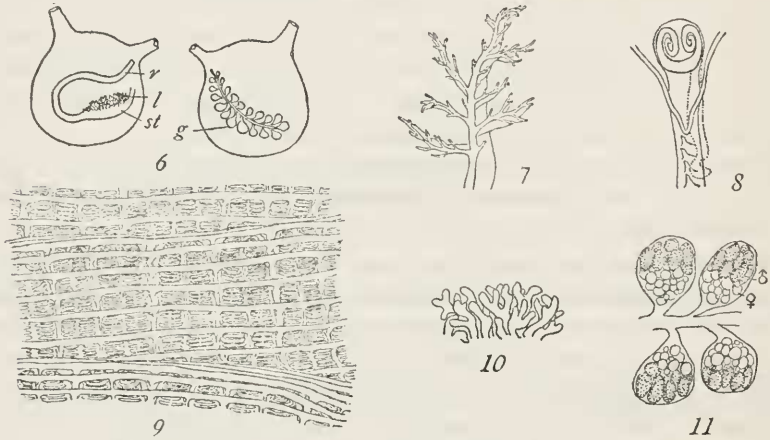
CTENYURA INTERMEDIA, new species.

Plate 32, fig. 42.

Body of irregularly rounded form, attached by a wide area on the ventral surface, with widely separated, diverging retractile tubes, which, though capable of considerable extension, may not project much beyond the surface when retracted. This is partly owing to the great thickness of the test. Lobes of the apertures not readily counted in the contracted state. Several individuals sometimes adhere together. Test very thick, semicartilaginous, rather translucent, of a dirty white color; the external surface, which is rough and

coarsely wrinkled, being stained with mud but without much adherent foreign matter. Diameters of one of the largest specimens, antero-posterior 18 mm., dorso-ventral 16 mm., transverse 16 mm.

When removed from the test the lobation of the branchial aperture is still obscure; the atrial aperture is square. Mantle musculature strong on dorsal part of body; sphincters of the tubes strong and thick. Numerous closely placed circular muscle bands surround the bases of the tubes. Fairly numerous and stout radial bands also extend from each tube nearly or quite to the ventral region, and are crossed by narrow and more numerous transverse or circular bands, forming a network very dense on the dorsal part of the body, but more open as the ventral region is approached.



FIGS. 6–11.—CTENYURA INTERMEDIA, NEW SPECIES. 6, LEFT AND RIGHT SIDES OF BODY. × 1.5. 7, TENTACLE. × 15. 8, DORSAL TUBERCLE AND PART OF DORSAL LAMINA. × 5. 9, PART OF BRANCHIAL SAC. × 15. 10, HEPATIC TUBULES. × 5. 11, PART OF GONAD. × 6.

Tentacles only moderately numerous, of several sizes, somewhat irregularly distributed. The largest ones apparently number about 6 and are 2 or 3 times compound with rather few and irregular branches, but they bear broad membranes. Tips of smallest branches blunt and rounded though scarcely if at all enlarged.

Dorsal tubercle very large and prominent, horseshoe-shaped with strongly in-rolled horns; open interval forward (observed in a number of specimens).

Dorsal lamina represented by a series of small closely placed languets.

Branchial sac with seven very prominent folds on each side, separated by comparatively narrow intervals. Three orders of transverse vessels regularly arranged; additional still smaller vessels cross the stigmata in some places. Along the summit of each fold the sac is raised into a row of small infundibula, separated from each other by

transverse vessels of the first or second order. The infundibula mostly divide near the summit into an anterior and a posterior apex, separated (when the division is sufficiently well marked) by a third order transverse vessel. Stigmata in most places merely short longitudinally placed slits arranged as usual in the family Tethyiidae, but as the upper part of an infundibulum is approached they become curved, assuming a spiral arrangement on the apex. Internal longitudinal vessels numerous (over 20 on a fold in large individuals), separated on the lower part of the folds by from three to five stigmata but by six or eight on the intervals between folds. Assuming that two internal longitudinal vessels are to be regarded as belonging to each interval between folds, their distribution in a medium-sized specimen was about as follows:

dorsal 1 (15) 2 (17) 2 (19) 2 (18) 2 (15) 2 (12) 2 (10) 2 *ventral.*

Digestive tract forming a broad, open loop; stomach elongated, not well differentiated from the other parts of the tract except by bearing on its dorsal surface numerous short crooked branching hepatic tubules of a green color. Rectum short, margin of anus thin and irregular but not deeply lobed.

No kidney was found.

A gonad is present on the right side only. It consists of a long curved obliquely placed oviduct (probably accompanied by a sperm duct) ending close to the base of the atrial tube and bearing along each side small pear-shaped or irregularly rounded sacs (a dozen or 20 in all) connected with it by short side ducts. Each sac contains eggs in the proximal part and a number of small testes of oval form in the distal part.

Collected only at station D5536 (between Negros and Siquijor, 279 fathoms, green mud, Aug. 19, 1909). Over a dozen specimens (No. 140; Cat. No. 6036 type and 6035 paratypes, U.S.N.M.).

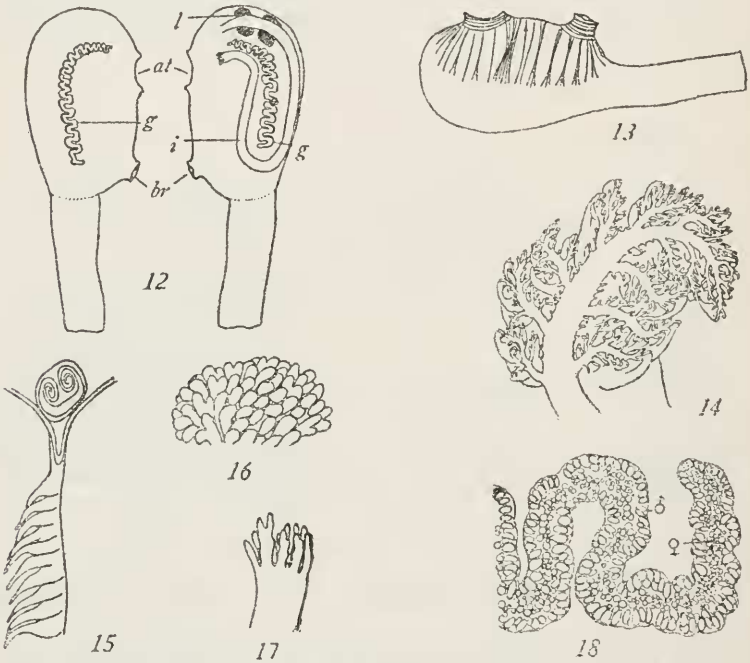
Genus PYURA Molina, 1810.

[*Cynthia* s. *Halocynthia* Authors, part.]

In the present paper the writer adopts Huntsman's (1912) limitation of the genus *Tethyum* to *T. papillosum* (Linnaeus) and its near allies having a number of small bottle-shaped gonads (often more or less fused together by their closed ends) on each side of the body, leaving the name *Pyura* Molina still available for the majority of the members of the old genus *Cynthia* Savigny, 1816. These have the dorsal lamina replaced by a series of languets, the intestine forming a widely open loop, and one or two elongate gonads (sometimes consisting of small separate glands arranged along a common duct) on each side of the body.

PYURA INFLATA, new species.

Body of the only specimen egg-shaped, larger and more rounded at the posterior end. From the anterior end, somewhat toward the ventral side, there arises a stout cylindrical pedicel of almost uniform diameter throughout its length, which does not equal that of the body. Branchial aperture of moderate size, square, raised on a very short tubular prominence arising from the anterior dorsal region. Atrial aperture very large, rounded, but little raised above the surface of the body and situated in the posterior dorsal region. Test



FIGS. 12–18.—PYURA INFLATA, NEW SPECIES. 12, RIGHT AND LEFT SIDES OF BODY. ONE-HALF NATURAL SIZE 13, OUTLINE OF BODY SHOWING MUSCLE BANDS ON MANTLE. ONE-HALF NATURAL SIZE. 14, MEDIUM-SIZED TENTACLE. × 12.5. 15, DORSAL TUBERCLE AND PART OF DORSAL LAMINA. × 12.5. 16, PART OF LIVER. × 35. 17, END OF RECTUM SHOWING ANAL LOBES. × 8. 18, PART OF GONAD. × 12.

thin, tough, and parchmentlike, nearly smooth externally and of a yellowish white color. Outer layer of pedicel similar to the test covering the body; internally the pedicel is partly hollow, the remainder being filled with test substance of rather soft consistency.

Mantle thin, very strongly adherent to the test. Conspicuous muscle bands are few, comprising only a few circular bands about the apertures (especially about the branchial aperture), and some rather short straight bands running in a dorso-ventral direction on each side of the body, but ending abruptly after extending about halfway down the sides. They are mostly gathered into groups of

three to five bands; the bands composing these groups diverge more or less at the ventral and dorsal ends of the groups, and do not generally extend across the middorsal line of the body. Needle-like calcareous spicules quite similar to those found in *Pyura pallida* (Heller) (see p. 77) occur sparingly in some of the tissues of the body, especially in the larger transverse vessels of the branchial sac. Length of body, 50 mm.; of pedicel, 35 mm.; greatest diameter (dorso-ventral) of body, 31 mm.; of pedicel, 13 mm.

Tentacles large, numerous, and extensively though rather irregularly branched, and provided with very well-developed membranes. The small branches end in blunt rounded tips. Largest tentacles, four in number, several times compound; at least two or three orders of smaller tentacles, also more or less extensively branched and quite regularly arranged according to the usual scheme.

Dorsal tubercle rather small; orifice C-shaped with inrolled horns; open interval directed obliquely forward and to the right.

Dorsal lamina broken up into a series of rather long pointed languets placed close together; their bases are wide in a transverse direction.

Branchial sac with at least 11 folds on the right and 10 on the left side. Additional rudimentary folds may be present in the anterior part of the sac, which is too tangled to admit of satisfactory examination. Folds high in proportion to the width of the intervals between them. Transverse vessels of about three orders are fairly regularly arranged, the smallest crossing the stigmata in some places without interrupting them; in others they divide the stigmata. Stigmata narrow, placed with their long diameter parallel to the body axis; the interstigmatic longitudinal vessels are generally broad and flat, often much exceeding the narrow slit-like stigmata in width. Internal longitudinal vessels generally separated by only four or five stigmata on the intervals between folds. Approximate distribution of the internal longitudinal vessels:

d. 2 (20) 2 (23) 2 (26) 3 (24) 2 (21) 3 (18) 2 (15) 2 (13) 2 (10) 1 (8) 1 *v.*

Digestive tract forming a long horizontal loop whose branches lie well apart throughout their length. Stomach elongated and not well differentiated from the other parts of the tract except by bearing two large masses of small, short, closely placed, and only slightly branched hepatic tubules on the aspect toward the branchial sac. Rectum rather short, directed dorsally; the margin of its aperture produced into a number of long irregular lobes.

One elongated gonad on each side. It is thrown into numerous sinuous curves, but has a general antero-posterior direction except that it is turned up dorsally at the posterior end. On the left side the gonad lies within the intestinal loop. Apparently each gonad

has a central elongated ovary bordered by the numerous small simple testes.

The type and only specimen (No. 118) (Cat. No. 603F, U.S.N.M.) was taken at station D5166, (near Observation Island, Sulu Archipelago, 97 fathoms, coral sand, February 24, 1908).

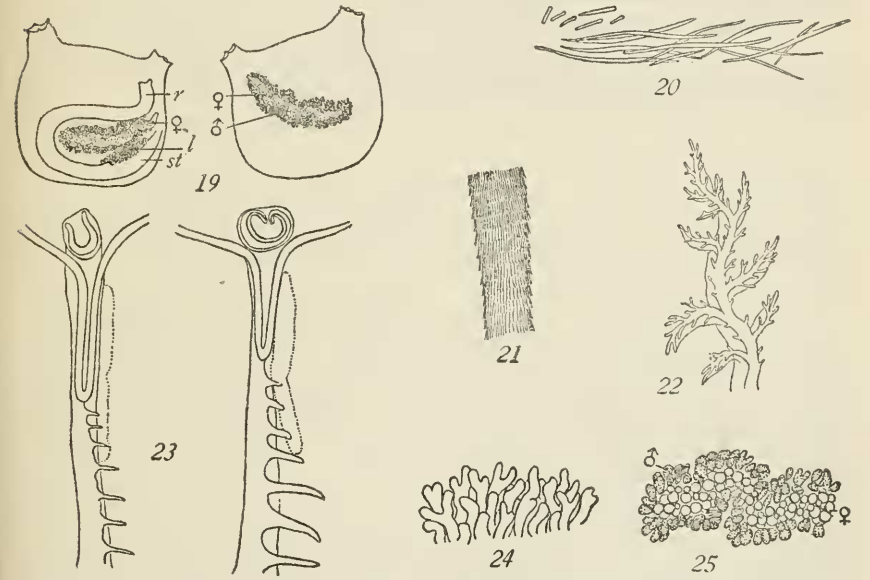
PYURA PALLIDA (Heller), 1878.

Plate 32, figs. 36–38.

1878. *Cynthia pallida* Heller, Sitz.-Ber. Akad. Wiss. Wien, vol. 77, p. 96, pl. 3, figs. 17–18.
1881. *Cynthia pallida* Herdman, Proc. Roy. Soc. Edinburgh, vol. 11, p. 60.
1882. *Cynthia pallida* Herdman, Rep. Voy. *Challenger*, vol. 6, Tunicata, p. 143, pl. 17, figs. 17–21.
1883. *Cynthia pallida* Traustedt, Vidensk. Meddel. Natur. For. Kjobenhavn, ann. 1881, p. 119.
1885. *Cynthia pallida*, var. *billitonensis* Sluiter, Natuurk. Tijdschr. Neder. Ind., vol. 45, p. 183, pl. 1, fig. 6; pl. 2, figs. 1–11.
1885. *Cynthia pallida* Traustedt, Vidensk. Meddel. Natur. For. Kjobenhavn, ann. 1884, p. 35.
1886. *Cynthia pallida*+*C. pallida*, var. *billitonensis* Herdman, Rep. Voy. *Challenger*, vol. 14, Tunicata, App. A, p. 405.
1890. *Cynthia pallida*, var. *billitonensis* Sluiter, Natuur. Tijdschr. Neder. Ind., vol. 50, p. 331.
1891. *Rhabdocynthia pallida*+*R. pallida*, var. *billitonensis* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 575.
1897. *Rhabdocynthia pallida* Sluiter, Zool. Jahrbücher, Syst., vol. 11, p. 7.
1904. *Rhabdocynthia pallida* Sluiter, *Siboga*-Exped., vol. 56*a*, p. 54.
1905. *Halocynthia pallida* Hartmeyer, Zool. Jahrbücher, Syst., suppl. vol. 8, p. 384.
1905. *Rhabdocynthia pallida* Sluiter, Bull. Mus. Nat. Hist. Paris, 1905, p. 102.
1905. *Halocynthia pallida* Michaelsen, Zool. Jahrbücher, Syst., suppl. vol. 8, p. 83.
1905. *Rhabdocynthia pallida* Sluiter, Mem. Soc. Zool. France, vol. 18, p. 14.
1906. *Rhabdocynthia pallida* Herdman, Ceylon Pearl Oyster Fisheries, Supplementary Report, No. 39, p. 308, pl. 2, figs. 36–39.
1906. *Halocynthia pallida* Hartmeyer, Zool. Anzeiger, vol. 31, p. 4, text-fig. 2.
1908. *Pyura pallida* (form *typica*) Michaelsen, Mitth. Mus. Hamburg, vol. 25, p. 270.
1909. *Pyura pallida* (form *typica*) Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1340.
1912. (*Pyura*) *pallida* Hartmeyer, Denkschr. Akad. Wiss. Wien, vol. 88, math.-nat. Kl., p. 17.
1912. *Pyura pallida* Hartmeyer, Deutsche Tiefsee-Exped., vol. 16, pp. 361, 363.
1913. *Pyura pallida* Hartmeyer, Zool. u. anthr. Ergeb. Forsch. Südafrica, vol. 5, p. 128.

Body as seen from one side generally irregularly rounded or quadrate and more or less compressed laterally; the attachment by a rather small area on the ventral surface or more or less on one side.

Apertures (both 4 lobed) wide apart on dorsal side, the branchial generally the most prominent, though in the contracted preserved specimen neither aperture may project much. As would be expected, there is in the considerable series of specimens collected much variation in external characters. Test moderately thick, of an opaque white color; tough and leathery in alcoholic specimens, but softer and more translucent in formalin specimens. Outer surface uneven, with wrinkles and irregular depressions and elevations, yet in places moderately smooth, and only occasionally much incrusted with foreign matter. Inner surface of test white and glistening. The



FIGS. 19–25.—PYURA PALLIDA (HELLER). 19, LEFT AND RIGHT SIDES OF BODY. × .75. 20, SPICULES. THE LONG ONES ARE FROM THE MANTLE, THE SHORT ONES FROM THE TEST. × 15. 21, PART OF A SPICULE. × 225. 22, TENTACLE. × 15. 23, DORSAL TUBERCLE AND PART OF DORSAL LAMINA OF TWO INDIVIDUALS. × 9. 24, HEPATIC TUBULES. × 20. 25, PART OF GONAD. × 4.

dorso-ventral diameter may be less than, or may exceed, the length. Size of one of the largest specimens: Length, 45 mm.; dorso-ventral (inclusive of elevation bearing branchial orifice), 52 mm.; lateral diameter, about 15 mm. Apertures nearly 30 mm. apart.

Tissues of the mantle (and to a less extent those of some of the other internal structures of the body) containing slender, slightly curved needlelike calcareous spicules, which taper toward one or both ends. They are densely covered with minute appressed spines arranged in rings (fig. 21). All the spines point toward one end of the spicules; this end is not so sharp as the other. The spicules are mostly between 0.75 mm. and 2 mm. in length, but larger and smaller ones also occur. Similar, but much smaller, and proportionately

much shorter and stouter spicules occur in the test. These are often very blunt at both ends, and one end may be somewhat enlarged, forming a rounded head studded with minute projections. Spicules with such an enlarged end (the so-called "scepter-shaped" spicules) may have the opposite end either blunt or tapering to a point.

Tentacles of unequal sizes irregularly arranged; 11 large ones (not all of one size) and as many smaller ones of various sizes were counted in a fairly large individual. The largest are two or to some extent three times compound, but the branches are not numerous. They bear broad membranes. The tips of the small branches are often, but not always, slightly swollen.

Dorsal tubercle horseshoe-shaped with the open interval forward. The horns are generally incurved or more or less inrolled in large specimens, but in one individual they turn slightly out.

Dorsal lamina broken up into a series of long, narrow, pointed processes.

Branchial sac, with well-developed folds separated by rather narrow intervals. The number of folds varies in different individuals and will probably be found to average greater in old and large ones. In medium sized, yet fully adult, individuals there are 9 on each side, or often only 8 on the left side, while in one large specimen as many as 12 (the last two very rudimentary) were found on the right side. They could not be accurately counted on the left side of this specimen. Transverse vessels of four or five orders, often quite regularly arranged; the small ones cross the stigmata. Stigmata of moderate length and usually quite narrow. Internal longitudinal vessels numerous, rather slender, placed fairly close together on the sides of the folds, but separated by from 6 to 10 (or even 12) stigmata on the intervals between folds. The following was their approximate distribution in one of the larger specimens:

d. 4 (16) 3 (20) 2 (22) 2 (23) 2 (22) 3 (18) 2 (14) 2 (10) 1 (5) 0 *v.*

Digestive tract curved in a simple broad loop. Stomach elongated, having on its dorsal and mesial aspects a large and dense mass of small, short hepatic tubules of a greenish color, which are crooked and often slightly branched. Rectum very short, margin of anus with two lips, or somewhat sinuous, but not conspicuously lobed in the individuals examined.

One elongated slightly curved horizontally or obliquely placed gonad on each side. Each gonad consists of a long sinuously curved ovary bordered by the numerous small irregularly shaped testes. On the left side the gonad lies in the intestinal loop, though the intestine may overlap it a little at one or more points where the ovary forms wide sinuous curves.

This is evidently a common and widely distributed species in the Philippines. The stations for it listed below are all in shallow water (34 fathoms or less), except one in 279 fathoms:

No. 132. Catbalogan, Samar, April 14, 1908 (Cat. No. 5993 U.S.N.M.).
No. 147. Catbalogan, Samar, April 16, 1908 (Cat. No. 599F U.S.N.M.).
No. 44. Station D5555 (off Caballan Point, Jolo Island, 34 fathoms, coarse sand, September 18, 1909). Two specimens. (Cat. No. 6004, U.S.N.M.)
No. 72. Station D5174 (off Jolo Light, 20 fathoms, coarse sand, March 5, 1908). One small specimen. (Cat. No. 5910, U.S.N.M.)
No. 133. Station D5536 (near Apo Island, 279 fathoms, green mud, August 19, 1909). Four specimens. (Cat. No. 6003, U.S.N.M.)
Nos. 138, 144. Station D5147 (off Sulade Island, Sulu Archipelago, 21 fathoms, coral sand and shells, February 16, 1908). Three specimens. (Cat. No. 6000 U.S.N.M.)
No. 71. Station D5149 (off Sirum Island, Sulu Archipelago, 10 fathoms, coral and shells, February 18, 1908). One small specimen. Cat. No. 5912 U.S.N.M.)
No. 141. Station D5151 (off Sirum Island, Sulu Archipelago, 24 fathoms, coral sand and shells, February 18, 1908). One specimen. (Cat. No. 6001 U.S.N.M.)
No. 139. Station D5168 (off Observation Island, Sulu Archipelago, 28 fathoms, coral sand, February 24, 1908). One specimen. (Cat. No. 6002, U.S.N.M.)

It is widely distributed in warm seas and a number of geographical races, treated as allied distinct species, or as subspecies of *Pyura pallida*, have been distinguished.[1] A majority of the Philippine specimens would find place in the typical form of the species, which is recorded from Tahiti, Palau, Ceylon, the western Indian Ocean, the Cape of Good Hope, and the West Indies, as they have eight or nine branchial folds on one side. Those with a larger number of folds would agree better with either the Japanese form, or with the Australian form, *grandis*. The writer does not however see sufficient reason to believe that more than one subspecies occurs in the Philippines, and is inclined to question the necessity of dividing the species into as many races as Michaelsen (1908) accepts.

PYURA DUPLICATA, new species.

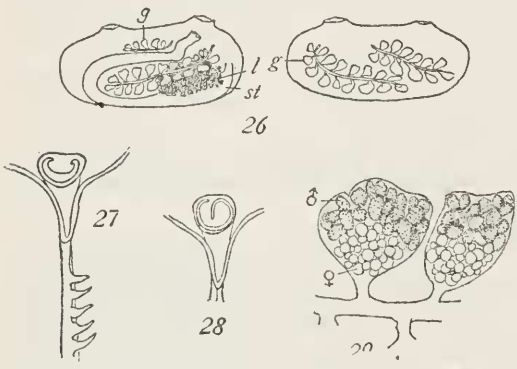
Plate 31, fig. 32.

One of the two specimens in the collection was attached by the greater part of the ventral region, and is flattened in an obliquely dorso-ventral direction; the apertures are on low rough elevations on the dorsal surface. The branchial and atrial apertures are about equally distant from the anterior and posterior ends of the body, respectively; the atrial aperture is distinctly 4-lobed, the branchial is

[1] See especially Michaelsen, 1908, p. 270, and 1912, p. 178.

too much contracted to show the lobes. Though preserved in formalin, the test is tough and cartilagenous, rather thick, with numerous fine sharply defined wrinkles on the surface, becoming especially rough about the apertures. Color (retained even a long time after transferring to alcohol) bright crimson on the exposed surface; more or less of the red color pervades also the substance of the test but not the mantle or internal organs. Size 22 mm. long, 19 mm. wide, and 15 mm. in extreme dorso-ventral diameter. Apertures 10 mm. apart.

The other specimen evidently grew on some slender object, perhaps a branch of an alcyonarian, and though also attached by the whole length of the ventral surface, the body is more cylindrical, and the apertures are nearer together, the branchial aperture being terminal and in this case clearly 4-lobed. The surface is smoother than in the first specimen, and the test white, only slightly tinged with red. The size is slightly larger (26 mm. long).



FIGS. 26–29.—PYURA DUPLICATA, NEW SPECIES. 26, LEFT AND RIGHT SIDES OF BODY. × 1.5. 27, DORSAL TUBERCLE AND PART OF DORSAL LAMINA. × 10. 28, DORSAL TUBERCLE OF ANOTHER INDIVIDUAL. × 10. 29, PART OF GONAD. × 5.

The following description of the anatomy is based on the first-mentioned specimen, the other being in poor condition internally and not having the gonads developed.

Mantle muscles well developed, strongest on the dorsal region and right side. Narrow but numerous and very closely placed bands radiate from the bases of the siphons and extend far down on the sides of the body. They are overlaid by closely placed circular bands on the dorsal region. Ventrally the musculature becomes thinner and more diffuse, narrow groups of fibers crossing each other in various directions.

For some reason not clearly apparent the tentacles were in a poor state of preservation. Apparently they are scantily branched, though provided with very broad membranes.

Dorsal tubercle rather large, but not prominent, its orifice crescent-shaped with the horns strongly turned in and the concavity forward. (In the other specimen the orifice forms nearly a circle, the short open interval being forward. One horn only is strongly bent inward.)

Dorsal lamina broken up into a series of moderately long, closely placed languets.

Branchial sac with seven folds on each side, the last fold much lower than any of the others. Transverse vessels numerous, mostly of two sizes placed alternately; additional slender vessels crossing the stigmata also occur in some places. Internal longitudinal vessels narrow but rather numerous, generally separated on the intervals between folds by five or six stigmata. Their distribution is about as follows:

dorsal 1 (16) 2 (18) 2 (21) 3 (20) 3 (18) 3 (13) 3 (9) 1 *ventral.*

Digestive tract forming a rather long narrow loop. Stomach elongate, bearing on its dorsal aspect an extremely large mass (or several closely adjacent masses) of rather long slender branching hepatic tubules. Rectum short; margin of anus with a number of rounded lobes.

Two gonads on each side; on the left side a large one consisting of small irregularly shaped sacs arranged along each side of a common oviduct lying within the intestinal loop, and a small one dorsal to the loop consisting of a single row of a few sacs along only one side of a short common oviduct. On the right side the two gonads are more nearly of the same size.

Both of the two specimens were taken at Catabalogan, Samar.

Type.—Cat. No. 6038, U.S.N.M.

Genus MICROCOSMUS Heller, 1877.

MICROCOSMUS EXASPERATUS Heller, 1878.

Plate 32, fig. 39.

1878. *Microcosmus exasperatus* + *M. variegatus* + *M. distans* + ? *M. affinis* Heller, Sitzungsber. Akad. Wiss. Wien, Math.-nat. class., vol. 77, pp. 98–100, pl. 1, fig. 6; pl. 3, figs. 19–20; pl. 5, fig. 27.

1882. *Microcosmus variegatus* Traustedt, Vidensk. Meddel. Nat. For. Kjobenhavn, ann. 1882, p. 47, pl. 5, figs. 10–11; pl. 6, fig. 17.

?1883. *Microcosmus claudicans* Traustedt, Mitth. Zool. Stat. Neapel, vol. 4, p. 476, pl. 36, fig. 11; pl. 37, fig. 7.

1885. *Microcosmus variegatus* Traustedt, Vidensk. Meddel. Nat. For. Kjobenhavn, ann. 1884, p. 42.

1891. *Microcosmus exasperatus* + *M. variegatus* + *M. distans* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, pp. 514–515.

1900. *Microcosmus miniatus* Verrill, Trans. Connecticut Acad. Sci., vol. 10, p. 590.

1902. *Microcosmus miniatus* Van Name, Trans. Connecticut Acad. Sci., vol. 11, p. 396, pl. 56, fig. 79; pl. 57, figs. 91–95; pl. 62, figs. 129–130; pl. 64, fig. 148.

1908. *Microcosmus exasperatus*, subspecies *typicus* Michaelsen, Mitth. Naturhist. Mus. Hamburg, No. 25, pp. 271–278, pl. 2, fig. 11.

1909. *Microcosmus exasperatus*, subspecies *typicus* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl. p. 1345.

1912. *Microcosmus exasperatus* Hartmeyer, Denkschr. Acad. Wiss. Wien, Math.-Nat. Class., vol. 88, pp. 8–9.

Body irregularly oblong, laterally compressed, especially in the dorsal region, the tubes arising from the dorsal part of the body far apart and pointing almost forward and backward respectively; the branchial tube is the larger and longer of the two. Attachment by the ventral region. Both apertures four-lobed. Test moderately thick, tough and opaque, of a dirty whitish color. Surface of body rough and uneven, and more or less overgrown with other organisms except in the smallest specimens. Size of largest specimen, 60 mm. long and 38 mm. in dorso-ventral diameter.

Mantle thin and somewhat transparent, with numerous regularly disposed, rather broad, but not very compact muscle bands, which radiate from the bases of the tubes and extend down on the sides to the ventral region. On the sides they cross each other, forming an open network with nearly square meshes.

FIGS. 30–32.—MICROCOSMUS EXASPERATUS HELLER. 30, LEFT AND RIGHT SIDES OF BODY. × .75. 31, TENTACLE. × 10. 32, DORSAL TUBERCLES OF TWO INDIVIDUALS. × 3.5.

Tentacles of several sizes, the large ones consisting of a stout tapering stem bearing a wide membrane and very short tapering lateral branches, which in turn bear a few lateral projections or more or less rudimentary branches. The tentacles of the first two orders number together about a dozen; small tentacles are few.

Dorsal tubercle large, irregularly C-shaped with the open interval to the left (nearly forward in the largest specimen) and the horns inrolled.

Dorsal lamina a plain-edged rather wide membrane.

Branchial sac with 9 folds on the left and 10 on the right side, the last one incomplete or rudimentary, and the one next to it also reduced. Transverse vessels of about four orders, the smallest crossing the stigmata. They exhibit considerable irregularity in arrangement in some parts of the sac, especially as far as the smaller vessels are concerned. Five to eight stigmata generally intervene between internal longitudinal vessels on the intervals between folds. Distribution of internal longitudinal vessels on the right side of body in two specimens is about as follows:

Smaller specimen:
d. 4 (21) 4 (22) 4 (22) 5 (25) 5 (25) 6 (19) 5 (17) 4 (14) 2 (10) 2 (3) 1 *v.*

Larger specimen:
d. 4 (26) 5 (30) 6 (36) 6 (34) 5 (30) 5 (26) 5 (24) 5 (20) 4 (16) 3 (5) 1 *v.*

Digestive tract forming a narrow loop quite abruptly curved up dorsally at the reflected end and opened out there for a short distance. Farther back the stomach and intestine lie nearly in contact for a long distance. Stomach elongate, tapering into the intestine. It bears on the side next to the branchial sac two hepatic glands (the posterior the larger), each formed of many lobes composed of thin platelike glandular folds of a greenish color. Rectum short; margin of anus plain.

One gonad on each side; in each a long obliquely placed oviduct bears along its course several large, somewhat square or irregularly shaped bodies, each containing a central mass of eggs surrounded more or less completely by the small and very numerous testes. On the left side the most anterior one of the masses lies in the intestinal loop; the others lie dorsal to the intestine, which is crossed by the oviduct.

The specimens collected are from the following localities:

No. 155. Station D5136 (off Jolo Light, 22 fathoms, sand and shells, February 14, 1908.) Two specimens, adhering together. (Cat. No. 5979, U.S.N.M.)

No. 135. Station D5145 (off Jolo Light, 23 fathoms, coral sand and shells, February 14, 1908). One specimen. (Cat. No. 6034, U. S. N. M.)

No. 76. Station D5147 (off Sulade Island, Sulu Archipelago, 21 fathoms, coral sand and shells, February 16, 1908). One small specimen. (Cat. No. 5904, U.S.N.M.)

This is a very widely distributed species in tropical seas. Michaelsen, 1908, who discusses at length its characters, relationships, and synonyms, records the typical form from the West Indies, Bermuda, coast of East Africa, and Formosa. The writer can himself testify to the close correspondence in the internal structure of specimens from Bermuda with those from the Philippines.

Genus CULEOLUS Herdman, 1881.

CULEOLUS HERDMANI Sluiter.

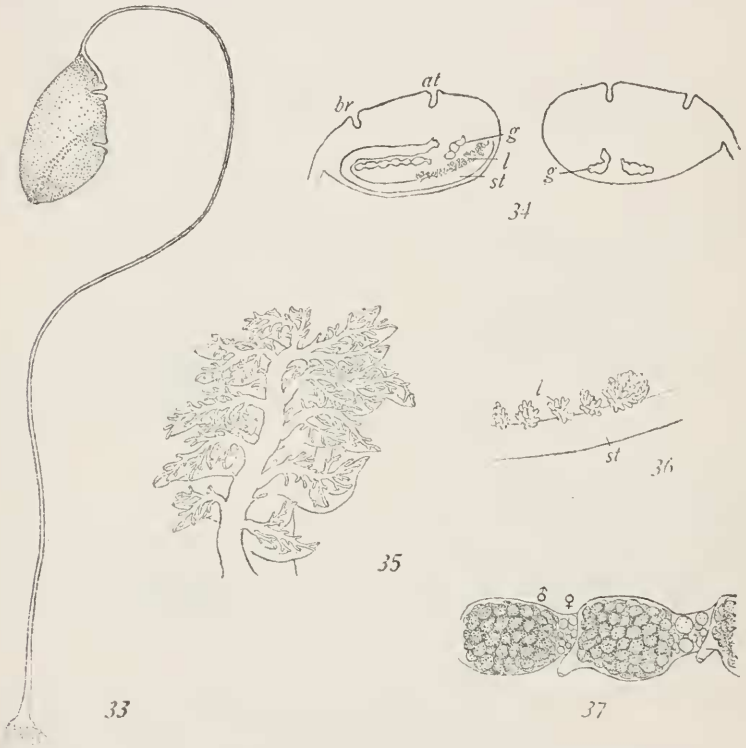
1904. *Culeolus herdmani* Sluiter, *Siboga*-Exped., vol. 56*a*, p. 105, pl. 12, figs. 4-9.

1909. *Culeolus herdmani* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1347.

Body of rather elongate ovate form, or more or less cuneate; greatest diameter posterior to the middle; the apertures (which both have the form of rather large transverse straight or somewhat crescent-shaped clefts) widely separated on the dorsal surface; the branchial a little way from the anterior end; the atrial posterior to the middle of the body. The stalk, which is slender and of nearly uniform diameter (though increasing slightly toward the base) joins the anterior dorsal part of the body and is continued as a ridge on the dorsal surface of the body nearly to the branchial aperture. It is more or less incrusted with sand. At its basal end the stalk breaks

up into a bunch of rootlike filaments by means of which the animal is anchored in the mud.

Test brownish white, tough and parchmentlike though thin; its surface slightly wrinkled, mostly free from incrusting material though some sand adheres, especially on a triangular area near and anterior to the branchial aperture. Under the microscope minute conical papillae can be seen scattered at wide intervals over the body surface; they are generally better developed around the



FIGS. 33–37.—CULEOLUS HERDMANI SLUITER. 33, EXTERNAL VIEW. × ABOUT .60. 34, LEFT AND RIGHT SIDES OF BODY. × .75. 35, LARGE TENTACLE. × 9. 36, PART OF STOMACH AND HEPATIC TUBULES. × 12. 37, PART OF A GONAD SEEN FROM THE SIDE NEXT TO THE BRANCHIAL SAC. ×20.

apertures, sometimes also on an oblique line, extending ventrally and posteriorly from near the atrial aperture on each side, but this line is not always conspicuous. No spicules were found either in the test or in the internal organs. Owing to wrinkling and distortion incident to preservation the body diameters can only be roughly estimated, but they are approximately as follows in the two largest examples:

Length of stalk.	Length of body.	Greatest transverse diameter.	Distance between apertures.
224 mm.	36 mm.	20 mm.	15 mm.
163 mm.	34 mm.	16 mm.	16 mm.

Mantle thin, firmly adherent to the test, its musculature composed chiefly of narrow and widely separated bands. The more conspicuous ones cross the dorsal region or radiate from the apertures, extending down on the sides. These are crossed by circular bands and fibers surrounding the apertures, or extending longitudinally on the body.

Number and arrangement of tentacles very variable. Each individual studied had one very large tentacle, and several others also large enough to leave no doubt that they should be considered as of the first order. Smaller and less extensively branched tentacles are present in the intervals; but only in a few parts of the circle was any regular arrangement recognizable. The largest tentacles, though of great size in proportion to the body of the animal, are not very complex in their branching, and are not more than three (or to a small extent four) times compound. The branching is quite irregular and the tips of the small branches are blunt and slightly enlarged. The tentacles bear broad membranes.

Dorsal tubercle small, the form of its orifice difficult to make out in the specimens examined, but apparently very simple, perhaps oval or crescent-shaped.

Dorsal lamina represented by a series of rather large triangular languets corresponding in number and position to the origins of the transverse vessels. Their broad diameter is transverse to the median dorsal vessel.

Branchial sac very delicate, the large meshes formed by the transverse and internal longitudinal vessels are generally not crossed by any smaller vessels, except that in a few places a small intermediate transverse vessel may extend across one or two successive meshes, rarely more. Only four distinct folds were positively demonstrated on each side; the rudiment of a fifth fold, indicated by two closely placed internal longitudinal vessels, was present on each side in one individual at least. The distribution of internal longitudinal vessels in that specimen was about as follows:

Left side: *dorsal* 0 (4) 2 (8) 1 (5) 1 (3) 1 (2) 0 *ventral.*
Right side: *dorsal* 0 (4) 1 (9) 2 (5) 2 (4) 0 (2) 0 *ventral.*

These vessels are spaced so as to form, with the transverse vessels, large square or oblong meshes on the intervals between folds; toward the summits of the folds they become more closely placed.

Alimentary loop horizontally placed, U-shaped, the dorsal branch (formed by the intestine) being the shorter of the two. Stomach long and narrow, tapering gradually into the intestine, and bearing on its dorsal aspect a row of tufts composed of somewhat branched hepatic tubules.

Gonads present on both sides of the body; on the left between the branches of the intestinal loop; on the right rather far back on the

side. The individual figured has two gonads on each side, but the number varies; the largest specimen has three on the left and two on the right side. The gonads themselves vary greatly in shape; when much elongated they are generally conspicuously constricted at one or more points; the ovaries alone extending through the constricted parts, while in the enlarged intervening segments small testes are also contained. Though the state of the specimens renders the study of the finer points of structure difficult, it seems not unlikely that the ovary discharges by an orifice at the posterior end of the entire gonad, while the testes in each segment probably discharge through an orifice on a papilla on that segment.

Collected by the *Albatross* expedition only at station D5623 (off Makyan Island, 272 fathoms, fine sand and mud, Nov. 29, 1909), where eight specimens (No. 102, Cat. No. 5978 U.S.N.M.) were taken. These agree fairly well in most character with Sluiter's specimens from several stations in the Malay region from depths ranging between 204 and 472 meters. The *Albatross* specimens have more vessels on some of the larger folds of the branchial sac, and the writer could find at most five instead of six folds on a side. However, considerable allowance must be made for individual variation in species of this genus, and the localities and depths lend support to the belief that no mistake is made in including them in the same species. As Sluiter (1904) has already pointed out, *C. herdmani* is very closely allied to *C. recumbens* Herdman, 1881,[1] although the latter is from a distant locality (between the Cape of Good Hope and Kerguelen Island) and much deeper water, 1,375 fathoms; but in this connection it is worthy of mention that Wood-Mason and Alcock (1891) record specimens which are very close to *C. recumbens*, "if not identical with it," from the Indian Ocean (station 110 of the Indian Marine Survey steamer *Investigator*, 1,999 fathoms), indicating a wide distribution for Herdman's species. With the information available it would, however, seem premature to conclude that the two species are identical.

Family STYELIDAE Sluiter, 1895.

[=TETHYIDAE Hartmeyer, 1908–1909, and Van Name, 1912, not Huntsman, 1912.]

Genus STYELA Fleming, 1822.

[=*Tethyum* Hartmeyer, 1908–1909, not Huntsman, 1912.]

STYELA AREOLATA Heller.

Plate 31, fig. 27.

?1823. *Ascidia plicata* Lesueur, Journ. Acad. Nat. Sci. Philadelphia, vol. 3, p. 5, pl. 3, fig. 6.

[1] See Herdman, 1882, p. 107, pl. 11, figs. 1–7; pl. 12, figs. 1–7.

?1883. *Styela plicata* Traustedt, Vidensk. Meddel. Naturh. For. Kjobenhavn, ann. 1882, p. 123, pl. 5, figs. 6, 16.

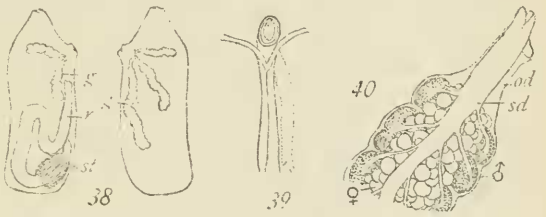
1878. *Styela arcolata* Heller, Sitz.-Ber. Akad. Wiss. Wien, vol. 77, p. 108, pl. 2, fig. 14.

1906. *Styela arcolata* Herdman, Ceylon Pearl Oyster Fisheries. Special Rep. No. 39, p. 316, pl. 4, figs. 24–33.

1909. *Tethyum arcolatum* Hartmeyer, Broon's Tier-reich, vol. 3, suppl., p. 1358.

The following description has been prepared from the specimen from station D5147 (Cat. No. 5930, U.S.N.M.) (see below), as it is the only one having the reproductive organs developed.

Body irregularly oblong or roughly cylindrical slightly curved, tapering abruptly at the anterior end and attached obliquely by the posterior part. Branchial aperture four-lobed, nearly terminal; atrial aperture probably also four-lobed, situated only a little way back on the dorsal side. Test rather thick and soft though tough, whitish externally with a slightly pearly lining; outer surface raised into irregularly rounded elevations of different sizes near the apertures, but smoother though not shiny on the posterior and ventral portions. Length 26m.; greatest dorso-ventral diameter, about 14m.; lateral diameter about the same.



Figs 38–40.—Styela areolata Heller. 38, Left and right sides of body. Natural size. 39, Dorsal tubercle. × 9. 40, Dorsal end of a gonad. × 12.5.

Mantle muscles fairly well developed; the superficial layer, consisting chiefly of circular and transverse fibers, forms a practically continuous sheet, especially on the dorsal and anterior parts; the deeper layer, consisting largely of muscles radiating from the apertures and extending down the sides, is gathered into bands.

Tentacles not very numerous; apparently about 16 large ones representing two orders and, in addition, smaller ones in some of the intervals.

Dorsal tubercle oval; its orifice horseshoe-shaped, with the open interval (which is so narrow as to easily escape notice) directed forward.

Dorsal lamina plain.

Branchial sac with four well-developed folds on each side. Four or five orders of transverse vessels quite regularly arranged in some places, the smallest crossing the stigmata. Internal longitudinal vessels broad and flat, not very numerous; generally separated by from five or six to eight or nine stigmata on the intervals between folds. (Next to the endostyle there are often 12 or more stigmata

before the last internal longitudinal vessel is reached). The following is their arrangement on the right side:

dorsal 4 (11) 3 (10) 4 (13) 3 (6) 4 *ventral.*

The stigmata are mostly quite long and narrow.

Stomach short and broad, with 20 or more distinct longitudinal folds. The intestine forms a narrow strong bent loop bending and extending forward after leaving the stomach, then doubling back so as to pass along close to the border of the stomach and turning abruptly forward to form the rectum, which is long and has a deeply lobed aperture.

Two gonads on the left and three on the right side. They have the form of stout, somewhat crooked tubes and are placed with their dorsal ends (where the orifice is situated) pointing toward the base of the atrial tube. They are well distended with eggs, which occupy the unattached side of the gonad (that next to the branchial sac), the testes, which are small and of simple or somewhat lobed form, being crowded to the part next to the mantle. The individual sperm ducts extend around on to the free side of the ovary and unite there in the usual manner to form the common sperm duct, which opens with a two-lipped orifice on a papilla beside the neck of the ovary.

Collected at two localities:

No. 88. Station D5147 (off Sirun Island, Sulu Archipelago, 21 fathoms, coral sand and shells, February 16, 1908). One large individual with a very small and immature one attached to its base. (Cat. No. 5930, U.S.N.M.)

No. 80. Station D5163 (off Observation Island, Tawi Tawi Group, Sulu Archipelago. February 24, 1908, 28 fathoms, coral sand). A fairly large (22 mm. long) specimen, apparently adult, but without gonads (Cat. No. 5929 U.S.N.M.).

There can hardly be a doubt of the identity of these specimens with those from Ceylon (greatest depth 20 fathoms) referred by Herdman (1906) to Heller's species. The Philippine specimen on which the description here given is based has fewer gonads on the right side; the usual number of gonads, according to Herdman, being 1 or 2 on the left and 4 to 6 on the right side. Heller's (1878) type was also from Ceylon. This species is doubtfully distinct from *Styela plicata* Lesueur, 1823, a large species widely distributed in the warmer parts of the world. See Traustedt, 1883.

STYELA TINAKTAE, new species.

Plate 32, fig. 40.

Body rather elongate and somewhat curved, considerably flattened from side to side, and attached in an oblique position by the left posterior part. Apertures slightly prominent, small, both 4-lobed;

the branchial terminal, the atrial a short distance back on the dorsal side. Test moderately tough and opaque, its substance whitish with a somewhat pearly lining, the outer surface of a brassy yellow color, rough with elevations separated by narrow but sharply defined furrows which cross each other in various directions. The elevations are largest and most irregular in form and size on the anterior and antero-dorsal parts of the body, becoming smaller and more numerous and more uniform in size on the posterior parts. Surface free from incrusting material. Largest specimen, 40 mm. long, 16 mm. in dorso-ventral diameter.

Mantle thick, adherent to the test, its muscular layers forming thick sheets.

Tentacles few, probably about 16, comprising two sizes or orders. No atrial tentacles found.

Dorsal tubercle elliptical, its orifice horseshoe shaped (nearly a complete oval) with the open interval forward.

Dorsal lamina plain-edged in some parts, somewhat notched or denticulate in others.

Branchial sac with four well-developed folds on each side separated by broad intervals. Transverse vessels of three or four sizes, not everywhere regularly arranged, the smallest sometimes crossing, sometimes separating stigmata. Internal longitudinal vessels numerous on the intervals as well as on the folds. The specimens were not in condition to permit of an accurate count; the following is no more than a rough approximation to the scheme of their distribution:

Right side: *dorsal* 10 (22) 9 (22) 9 (20) 7 (14) 5 *ventral.*
Left side: *dorsal* 4 (26) 8 (20) 8 (20) 7 (12) 6 *ventral.*

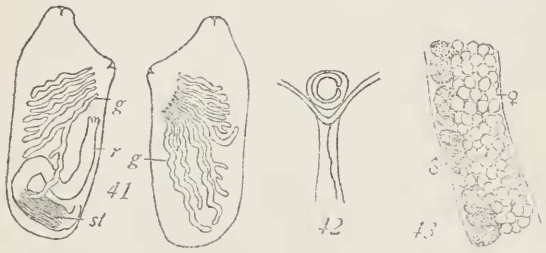
These vessels are separated on the intervals between folds by an average of five to seven stigmata. The latter are mostly rather long and narrow.

Stomach rather elongate, with over 20 not very distinct or regular longitudinal folds in its wall. Intestinal loop rather narrow in an antero-posterior direction; margin of anus irregularly lobed and plicated.

Gonads rather numerous on each side, especially on the right, long and tubular, always more or less sinuous, and sometimes very irregularly curved. Some are divided into two or more branches toward the closed (ventral) end. The dorsal ends of the gonads are directed toward the base of the atrial tube; on each side of the body the gonads lie nearly parallel to each other and quite close together, covering a considerable part of the side of the body. The ovary in each extends the whole length of the tube and fills all of it except the space occupied by the testes, which are rather large, pear-shaped or cleft into two or more lobes. They are rather irregulaly distibuted in the

gonad, lying against the side which is attached to the mantle. The individual figured (fig. 41) has 5 gonads on the left and 10 on the right side; another has about 6 on the left and 8 on the right side.

There are two specimens (No. 136) (Cat. No. 6041, U.S.N.M.) of this species from station D5159 (off Tinakta Island, Sulu Archipelago, 10 fathoms, coral sand, Feb. 21, 1908), both of nearly the same size and form. The stouter one is the type. There is also, in a bottle with no locality, a broader and more flattened specimen (No. 151) (Cat. No. 5991, U.S.N.M.), with an irregular laterally extending pedicel-like process of the test arising from the posterior part of the body, which evidently assisted in attaching the animal. The orifice of the dorsal tubercle is irregularly U-shaped instead of horseshoe shaped, but, as in the other specimens, the open interval is forward. Though the individual has no reproductive organs developed, it is probably of this species, which is apparently most closely allied to *Styela clara* Hartmeyer (1906, p. 13, text-fig. 7), from Hakodato, Japan. That form, however, has but four gonads on each side, fewer internal longitudinal vessels, atrial tentacles present, and a differently shaped body.



FIGS. 41–43.—STYELA TINAKTAE, NEW SPECIES. 41, LEFT AND RIGHT SIDES OF BODY. × .75. 42, DORSAL TUBERCLE. × 8. 43, PART OF A GONAD. (THE SIDE OCCUPIED BY THE TESTES IS ATTACHED TO THE MANTLE.) × 12.

A small specimen (No. 20) (Cat. No. 5932, U.S.N.M.) from station D5145 (near Jolo Light, February 15, 1908, 23 fathoms, coral and shells) may also belong to this species, but is so immature that this is uncertain. It has the body about 19 mm. long and is attached obliquely by the posterior end, which is produced into a pedicel-like extension that evidently assisted in attaching the body as in the case of the last-described specimen. The body surface is smoother than in the specimens described, though somewhat wrinkled, and the color is nearly white. In its internal structure it apparently corresponds sufficiently well with the present species if allowance is made for its immature condition.

Tentacles apparently about 16 in number.

Dorsal tubercle with a horseshoe-shaped orifice, the open interval forward.

Dorsal lamina plain-edged.

Four well-developed branchial folds on each side the internal longitudinal vessels distributed about as follows:

dorsal 3 (14) 5 (12) 4 (13) 4 (9) 4 *ventral.*

Three sizes of transverse vessels, the smallest of which may either cross or divide the stigmata. Five to seven stigmata usually intervene between internal longitudinal vessels on the intervals between folds.

Margin of anus lobed.

Ovaries long and tubular with the testes arranged along their sides. The gonads are however very immature and their number was not determined.

STYELA MAEANDRIA Sluiter, 1904.

1904. *Styela maeandria* Sluiter, *Siboga*-Exped., vol. 56*a*, p. 77, pl. 9, figs. 18–20.
1909. *Tethyum maeandrium* Hartmyer, Bronn's Tier-reich, vol. 3, suppl., p. 1359.

The single specimen which the writer has identified provisionally with this species is quite regularly egg-shaped, attached by the small end, and has the apertures very near together at the other end, the branchial being almost exactly terminal. Both are 4-lobed and only slightly prominent in the preserved specimen. Test thin and tough, the outside yellow, becoming browner anteriorly; the inner surface is yellowish and slightly pearly; the substance on section yellowish white. The outer surface is minutely wrinkled, the wrinkles being mainly transverse and very close together, especially in the posterior parts of the body. The rides between these wrinkles are broken up into minute elevations which are coarser and more prominent near the apertures. Height of specimen 31 mm.; greatest transverse diameter 18 mm.

44

45

Figs. 44, 45.—Styela maeandria Sluiter. 44, External view. × 1.1. 45. Dorsal tubercle. × 12.5.

Mantle rather thin but with its transverse and longitudinal muscular layers forming fairly continuous sheets.

The tentacles could not be satisfactorily counted.

Dorsal tubercle of circular outline, its orifice simply C-shaped with the open interval to the left and somewhat forward. Horns not incurved.

Dorsal lamina irregularly notched along the posterior part.

Branchial sac with four folds on each side separated by wide intervals. Transverse vessels numerous, of several sizes rather irregularly arranged in some parts of the sac, but in other parts more regularly; even the smallest generally separate rows of stigmata. Internal longitudinal vessels very numerous, closely placed on the intervals as well as on the folds. Even on the intervals they are generally separated by from two to four stigmata only. Stigmata

mostly very short and of oval outline. Approximate distribution of the internal longitudinal vessels.

Right side: *dorsal* 10 (34) 11 (28) 8 (30) 9 (14) 7 *ventral.*
Left side: *dorsal* 6 (36) 10 (20) 10 (23) 10 (11) 8 *ventral.*

Digestive and reproductive organs much as in *Styela tinaktae* just described. Stomach elongate, with numerous rather irregular plications in its wall. Rectum rather long; margin of anus with numerous long lobes.

On the right side six tubular more or less sinuous gonads were distinguished, placed in an oblique position more or less parallel to each other. On the left side the gonads were too much broken and displaced to satisfactorily determine their number and arrangement. They were evidently fewer than on the right side and were very crooked, irregular in their distribution and more or less branched.

The specimen (No. 48) (Cat. No. 5931, U.S.N.M.), is from station D5144 (off Jolo Light, 19 fathoms, coral sand, Feb. 15, 1908). The writer refers the specimen to Sluiter's species in spite of some discrepancies, believing that as Sluiter had but one specimen, and the writer also but one, considerable allowance may reasonably be made for individual variation; and that the combination of a branchial sac with such closely placed vessels and several long tubular gonads on each side of the body is a sufficiently unusual one to justify regarding various minor differences that exist as probably due to age or individual variation. Sluiter's specimen was from latitude 8° 23′ 30″ S., longitude 119° 4′ 36″ E., 69 meters.

Genus PANDOCIA Fleming, 1882 [POLYCARPA Authors].

PANDOCIA CIRCUMARATA (Sluiter), 1904.

Plate 26, figs. 7 and 8.

1904. *Styela circumarata* Sluiter. *Siboga*-Exped., vol. 56*a*, p. 70, pl. 1, fig. 4; pl. 9, fig. 1.
1909. *Pandocia circumarata* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1363.

Body rather elongated, tapering anteriorly, flattened from side to side and extended at the posterior end in the case of both of the two specimens into a short broad laterally flattened pedicel by which the animal is attached. Apertures small, obscurely 4-lobed, the branchial terminal, the atrial some distance back on the dorsal side. Test moderately thick, tough, opaque, of a yellowish white color with a pearly luster within and yellowish brown externally; external surface very rough and having a few deep furrows, longitudinal ones predominating, in addition to smaller wrinkles and rough depres-

sions and elevations. It is not much incrusted with foreign material, except on the pedicel. Dimensions of the two specimens:

	Station D5174.	Station D5144.
	mm.	*mm.*
Total length	114	100
Length of pedicel	44	18
Dorso-ventral diameter	33	42
Lateral diameter (average)	16	19
Distance apart of apertures	24	38

Mantle thick and opaque owing to the great development of the muscular layers, which form thick sheets. Mantle and internal tissues and organs light colored.

Large tentacles about 16, probably representing two orders; a few small ones irregularly distributed in the intervals.

Dorsal tubercle large, longitudinally elongate, with a C-shaped aperture; open interval to the left, horns inrolled.

Dorsal lamina rather narrow, but wider posteriorly, plain edged.

Branchial sac with four well-developed folds on each side. They rise abruptly and are separated by wide intervals. The larger vessels are very stout and muscular. Transverse vessels of about five orders, the smallest crossing the stigmata. Internal longitudinal vessels very numerous, separated on the intervals between folds by not more than five to seven stigmata on most parts of the sac and very closely crowded on the upper part of the folds. The following is an approximation to their distribution:

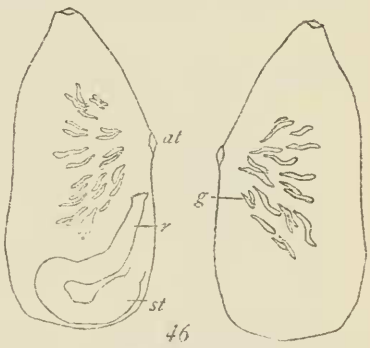


FIG. 46.—PANDOCIA CIRCUMARATA (SLUITER). LEFT AND RIGHT SIDES OF BODY. × .75.

Right side: *dorsal* 6 (42) 9 (33) 9 (37) 9 (28) 6 *ventral.*
Left side: *dorsal* 8 (40) 10 (30) 9 (35) 8 (22) 8 *ventral.*

Esophagus short, stomach rather short oval, its walls not much plicated externally; no pyloric caecum. Intestine large but forming a rather narrow loop. No abrupt bend at the beginning of the rectum, which is rather short. Margin of anus with many minute lobes.

Gonads small and numerous, irregularly distributed on both sides of the body, but so buried in the tissues of the body wall as to be difficult to distinguish. They are elongate or phial-shaped, often irregularly curved, and sometimes forked or branched. The numer-

ous small testes contained in them commonly lie in the part next to the mantle, crowding the eggs to the part next to the branchial sac, as in many other related species.

The two specimens in the collection are from these localities:

No. 116. Station D5174 (off Jolo Light, 20 fathoms, coarse sand, Mar. 5, 1908), (Cat. No. 6020, U.S.N.M.).

No. 112. Station D5144 (off Jolo Light, 19 fathoms, coral sand, Feb. 14. 1908), (Cat. No. 6019, U.S.N.M.).

Sluiter's type of this species, with the description and figures of which these specimens agree well in most characters, was also from the Philippine region (latitude, 6° 7′ 30″ N.; longitude, 120° 26′ E., 16–23 meters).

PANDOCIA AURATA (Quoy and Gaimard), 1834.

Plate 25, figs. 5 and 6.

1834. *Ascidia aurata* Quoy and Gaimard, Voyage Decouv. *Astrolabe*, Zool., vol. 3, p. 559, pl. 3.

1881. *Polycarpa sulcata* Herdman, Proc. Roy. Soc. Edinburgh, vol. 11, p. 73.

1882. *Polycarpa sulcata* Herdman, Rep. Voy. *Challenger*, Tunicata, vol. 6, p. 159, pl. 23, figs. 9–13.

1884. *Polycarpa sulcata* v. Drasche, Denk. Akad. Wiss. Wien, vol. 48, p. 379, pl. 6, fig. 12; pl. 7, figs. 1, 2, and 2*a*.

1885. *Polycarpa sulcata* Traustedt, Vidensk. Meddel. Nat. For. Kjobenhavn, ann. 1884, p. 48.

1890. *Styela psoloessa* Sluiter, Natuurk. Tijdschr. Neder. Ind., vol. 50, p. 339.

1891. *Styela psoloessa*+*Polycarpa sulcata* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, pp. 583, 585.

1895. *Stycla* (*Polycarpa*) *pneumonodes* Sluiter, Denkschr. med.-nat. Gesell. Jena, vol. 8, p. 179, pl. 10, figs. 1–3.

1898. *Polycarpa aurata* Herdman, Ann Mag. Nat. Hist., ser. 7, vol. 1, p. 445.

1899. *Polycarpa aurata* Herdman, Catalogue Australian Museum, Sydney, No. 17, pp. 51, 110.

1902. *Ascidia aurata* Willey, Zool. Results on Material from New Britain, New Guinea, etc., p. 712.

1904. *Stycla aurata* Sluiter, *Siboga*-Exped., vol. 56*a*, p. 57, pl. 7, fig. 16.

1906. *Polycarpa aurata* Herdman, Ceylon Pearl Oyster Fisheries, Supplementary Rep., No. 39, p. 318, pl. 5, figs. 1–6.

1908. *Polycarpa pedunculata* Pizon (not Heller, 1878), Rev. Suisse Zoologique, vol. 16, p. 216, pl. 12, figs. 21–24.

1909. *Pandocia aurata* +*P. pizoni* (new name for *P. pedunculata*) Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., pp. 1363 and 1484.

Body normally of peculiar and characteristic form, tapering at the anterior end, broad and rounded at the posterior end; usually but not always much compressed from side to side, and usually having the longitudinal body axis curved in about half a circle, so that the anterior end, having the branchial aperture at its tip, points di-

rectly upward, and the posterior end also more or less upward, the dorsal border of the body being deeply concave and the ventral very convex and very much longer than the dorsal. Atrial aperture on a papilla on the concave part of the dorsal border, near or behind the middle of the body. Both apertures 4-lobed. Attachment of the body by a small area on the convex ventral surface; this area being produced a little, sometimes to an extent making it proper to call it a thick short pedicel. Test thick, opaque, of the consistency of soft leather, smooth but not shining externally, and rather dark colored in the alcoholic specimens (some shade of brown or purple brown); not pearly within. The external surface has generally a few deep sharply defined but widely spaced furrows, mainly longitudinal in direction, but connected here and there by short cross furrows. The test contains branching vessels which end in rounded bulbs containing brown pigment. Many of them are large enough to appear as small spots conspicuous to the naked eye in sections of the test. Size

FIGS. 47, 48.—PANDOCIA AURATA (QUOY AND GAIMARD). 47, LEFT AND RIGHT SIDES OF BODY. ONE-HALF NATURAL SIZE. 48, DORSAL TUBERCLE. × 5.

of the largest specimen 90 mm. in greatest diameter and 25 mm. in maximum thickness.

Mantle thick, opaque, and adherent to the test, its muscles forming fairly continuous sheets. It is dark colored (brown), as are also the branchial sac and other internal organs.

Tentacles few (about 18 or 20) nearly all large, small ones being developed in few of the intervals.

Dorsal tubercle large and flattened, more or less triangular in outline; it has in place of a single orifice, a variable and often rather large number of minute straight or curved slits or oval openings distributed over its surface.

Dorsal lamina plain edged.

Branchial sac with four well-developed folds on each side, separated by wide intervals. The course of these folds is greatly curved, owing to the above-mentioned curvature of the body axis. In most parts of the sac the smaller transverse vessels are generally of fairly uniform size; at varying intervals larger ones occur, some being very large and stout. Small vessels crossing the stigmata are not present

in most places. Internal longitudinal vessels fairly numerous, both on the intervals and on the folds. In a fairly large specimen a count of them resulted as follows:

dorsal 4 (23) 5 (19) 6 (21) 4 (12) 5 *ventral.*

Stigmata numerous and narrow; 7 or 8 intervene between internal longitudinal vessels on the intervals between folds in the dorsal part of the sac; in the ventral part often 10 to 12, or more; next to the endostyle the fields often contain about 20 stigmata.

Intestine of large diameter, but forming a rather narrow loop in the posterior part of the body. Stomach inconspicuous, being neither of large diameter nor showing very distinct plications on the external surface. Rectum moderately long, making a fairly sharp bend at its origin. Margin of anus with many lobes.

Owing to the condition of the specimens, and to the fact that these organs are deeply buried in the thick opaque tissues of the mantle, the gonads are not easily distinguished. Apparently they are rather small short sacs containing eggs and small pyriform testes, and are distributed in moderate numbers on each side of the body (on the left side anterior to the intestinal loop only). No evidence was found of their becoming confluent with each other as in the next following species.

This species is represented by specimens from 5 stations; 21 fathoms being the greatest depth recorded.

No. 128. Mansalay, Mindoro (reef). June 4, 1908. One specimen, attached to a piece of coral. (Cat. No. 6014, U.S.N.M.)

No. 107. Surigao, east coast of Mindanao (reef). May 8, 1908. One specimen. (Cat. No. 6015, U.S.N.M.)

No. 161. Station D5254, off Linao Point, Gulf of Davao, 21 fathoms, sand and coral, May 18, 1908. One specimen. (Cat. No. 6018, U.S.N.M.)

No. 159. Station D5156, off Tinakta Island, Sulu Archipelago, 18 fathoms, fine sand and shells, February 21, 1908. One specimen. (Cat. No. 6017, U.S.N.M.)

No. 131. Tumindao Reef, south end, near Sibutu Island, Sulu Archipelago, February 26, 1908. Two specimens. (Cat. No. 6016 U.S.N.M.)

There are specimens in the United States National Museum from Porta Galera Bay, Mindoro, collected by S. F. Light, who reports it common also at Culion Apo, and at Tatay, Palawan.

This large and conspicuous form is common and widely distributed in the Malayan region, and was collected by the *Siboga* expedition at many stations, 74 meters being the greatest depth of any of them. Herdman, 1899, has described a variety (*plana*) from Port Jackson, Australia. In life *P. aurata* is said to be yellow or orange in color (Willey, 1902, p. 712). *Pandocia botryllifera* Michaelsen, 1912, from Samoa is evidently a very closely allied form.

PANDOCIA PEDATA (Herdman), 1881.

Plate 23, figs. 1–3.

1881. *Polycarpa pedata* Herdman, Proc. Roy. Soc. Edinburgh, vol. 11, p. 71.
1882. *Polycarpa pedata* Herdman, Rep. Voy. *Challenger*, vol. 6, Tunicata, p. 180, pl. 24, figs. 1 and 2.
1885. *Polycarpa pedata* Traustedt, Vidensk. Meddel. Nat. For. Kjobenhavn, ann. 1884, p. 48.
1891. *Polycarpa pedata* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 583.
1898. *Styela whitelcggci* Herdman, Ann. Mag. Nat. Hist., ser. 7, vol. 1, p. 445. (*Nomen nudum.*)
1899. *Styela whitelcggei* Herdman, Catalogue Australian Museum, Sydney, No. 17, pp. 40 and 110, pl. Cyn. II, figs. 6 and 7; pl. Cyn. XIV, figs. 1–6.
1904. *Styela pedata* Sluiter, *Siboga*-Exped., vol. 56*a*, p. 126. (Listed as not found by expedition.)
1908. *Polycarpa pedata* Pizon, Rev. Suisse Zoologique, vol. 16, p. 218.
1909. *Pandocia pedata*+*Tethyum whitelcggei* Hartmeyer. Brodn's Tierreich, vol. 3, suppl., pp. 1360 and 1364.

Body usually somewhat elongated, tapering toward the anterior end, where the branchial aperture is situated, and broader and rounded at the posterior end; it may be either somewhat compressed laterally or nearly round in cross section. Usually it is attached in a nearly horizontal position (assuming the ventral to be the lower side) by means of an irregular but often long and narrow pedicel arising from the ventral region posterior to the middle of the body. One or more accessory pedicels arising near the main one may assist in the attachment, or a whole group of root-like processes may replace the single pedicel, which in any case often breaks up at its foot into root-like processes for attachment. Usually the body axis is curved so that the anterior end, and often the posterior also, is turned up (dorsally) to a greater or less extent, but this curvature is generally less pronounced than in *P. aurata*. Atrial aperture on a more or less conspicuous conical elevation on the dorsal surface posterior to the middle of the body, sometimes very far back. Both apertures 4-lobed. The above description will apply more or less satisfactorily to most of the specimens in the collection, but variations in the shape of the body, the extent of curvature of the body axis, length and character of the pedicel or processes for attachment, etc., are very great. Test usually light colored, hard, tough, and opaque, not pearly within.

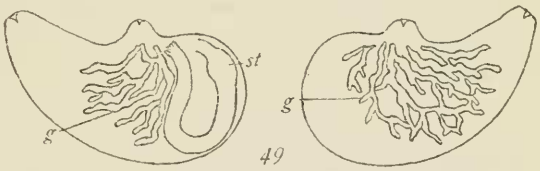


Fig. 49.—Pandocia pedata (Herdman). Left and right sides of body. × .6.

Outer surface very variable in character, often merely deeply and irregularly wrinkled and furrowed, but in most of the specimens a greater or less part of the body, especially in the dorsal and anterior regions, is covered with low flattened rounded elevations separated by narrow shallow furrows, giving the surface more or less the appearance of a cobblestone pavement. One large specimen (from station D5218), which is very irregular in form with a deeply and irregularly wrinkled surface, but is apparently of this species, measured about 78 mm. long by 44 mm. in height, exclusive of the processes for attachment. The other specimens are all considerably smaller, the largest 55 mm. long by 28 mm. high, exclusive of the pedicel and the papilla bearing the atrial orifice.

The mantle and internal tissues have a dark brown color, as in *P. aurata* described above, and the internal structure is so similar to that species that a separate description, other than a mention of certain small differences, will be needless.

The dorsal tubercle, though of similar structure, usually has more numerous and more minute apertures, giving its surface a spongy appearance.

Internal longitudinal vessels more numerous. In one of the large specimens their distribution is about as follows on the right side of the body:

dorsal 9 (24) 8 (22) 8 (25) 6 (19) 6 *ventral.*

They are separated by narrower intervals and fewer stigmata, only 3 or 4 on the intervals between folds in the dorsal region, and usually not over 5 or 6 in most parts of the ventral region except close to the endostyle.

Intestinal loop proportionately broad; there is usually practically no forwardly extending terminal section or rectum, the intestine making only a slight forward bend just before its termination, which is in a many-lobed orifice.

Gonads elongated branching tubes more or less confluent to an irregular network covering a large area on the right side and a smaller area (anterior to the intestinal loop) on the left side. Their branches often appear to anastomose so as to form meshes inclosed on all sides.

Localities of the specimens (one specimen from each):

No. 97. Station D5218 (between Burias and Luzon, near Anima, Sola Island, 20 fathoms, coarse sand, Apr. 22, 1908). Very large, irregularly shaped specimen (Cat. No. 6019, U.S.N.M.).

No. 149. Station D5251 (off Linao Point, Gulf of Davao, 20 fathoms, coral, May 18, 1908.) (Cat. No. 6011, U.S.N.M.)

No. 158. Station D5250 (near the last, 23 fathoms, coral sand, May 18, 1908). (Cat. No. 6010, U.S.N.M.)

No. 110. Station D5253 (near the last, 28 fathoms, coral, May 18, 1908). (Cat. No. 6012, U.S.N.M.)

No. 148. Station D5146 (off Sulade Island, Sulu Archipelago, 24 fathoms, coral sand and shells, Feb. 16, 1908), (Cat. No. 6006, U.S.N.M.).

No. 117. Station D5158 (off Tinakta Island, Sulu Archipelago, 12 fathoms, coarse sand and shells, Feb. 21, 1908), (Cat. No. 6007, U.S.N.M.).

No. 157. Station D5164 (off Observation Island, Sulu Archipelago, 18 fathoms, green mud, Feb. 24, 1908), (Cat. No. 6008, U.S.N.M.).

No. 123. Station D5640 (off Labuan Blanda Island, Buton Strait, 24 fathoms, sand and broken shells, Dec. 13, 1909), (Cat. No. 6013, U.S.N.M.).

No. 160. Tumindao Reef, south end, near Sibutu Island, Sulu Archipelago, Feb. 26, 1908. One small, irregularly shaped and doubtful specimen (Cat. No. 6005, U.S.N.M.).

The above considerable series of specimens well illustrates the variability in external form and appearance of this species and leaves no doubt in the writer's mind that *P. pedata* and *Styela whiteleggei* Herdman, 1899, must be considered identical. *P. pedata* was described by Herdman from a single specimen collected by the *Challenger* among the Philippine Islands, latitude 6° 55′ N.; longitude 122° 15′ E., 10 to 20 fathoms, sand. *Styela whiteleggei* was described by the same author (1899) from specimens from Port Jackson, Australia. The indications are that the species is widely distributed and that other forms described as distinct may eventually have to be united with it. Except for the fact that it has but nine openings in the dorsal tubercle, Herdman's description of *P. irregularis*, also from the Philippines, latitude 11° 37′ N.; longitude 123° 32′ E., 18 fathoms, mud (see Herdman, 1882, p. 178, pl. 23, figs. 7 and 8), does not seem to differ too greatly from the present species to be regarded as possibly identical, but if this conjecture be correct the name *pedata* will still have priority.

The close relationship between *P. pedata* and *P. aurata* (Quoy and Gaimard) is very evident from their curved body axis, peculiar dorsal tubercle, pigmented internal tissues, and other characters, but in the former species the gonads do not appear to fuse to form a complex network as in the present one.

PANDOCIA QUADRATA (Herdman), 1881.

Plate 31, fig. 34.

1881. *Polycarpa quadrata* HERDMAN, Proc. Roy. Soc. Edinburgh, vol. 11, p. 78.

1882. *Polycarpa quadrata* HERDMAN. Rep. Voy, *Challenger*, vol 6, Tunicata, p. 173, pl. 22, figs. 8–10.

1885. *Polycarpa quadrata* TRAUSTEDT, Vidensk. Meddel. Nat. For. Kjobenhavn. ann. 1884, p. 48.

1885. *Styela quadrata* SLUITER, Natuur. Tijdschr. Neder. Ind., vol. 45, p. 228.

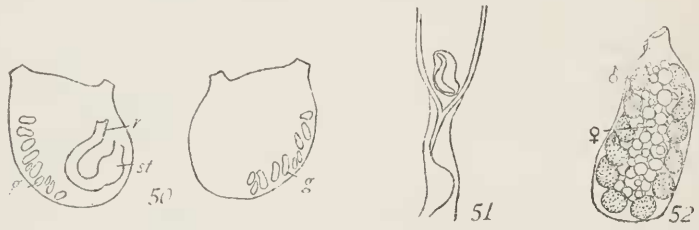
1891. *Polycarpa quadrata* HERDMAN, Journ. Linn. Soc. London, Zool., vol. 23, p. 583.

1904. *Styela quadrata* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 126.

1904. *Pandocia quadrata* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1364.

Body oblong or oval, more or less compressed laterally, attached by an area at or near the posterior end. Apertures both 4-lobed, quite widely separated, the branchial larger and nearly terminal, the atrial well back on the dorsal side, both but slightly if at all prominent in the preserved specimens. Test rather thin, dirty whitish in color; in the specimens preserved in formalin rather soft and flexible, but with a tough external layer. Surface wrinkled, bearing considerable adherent sand and mud; inner surface slightly pearly. Largest specimen 25 mm. long, 20 mm. in dorso-ventral diameter, and 12 mm. (estimated) from side to side.

Mantle musculature only moderately developed, very diffuse, consisting of separate fibers which cross each other in various directions, forming on most parts of the body a fairly continuous layer without being gathered into conspicuous bands. Even the muscle fibers radiating from the base of the tubes remain separate, or form only very small groups. They are overlaid by circular fibers.



FIGS. 50–52.—PANDOCIA QUADRATA (HERDMAN). 50, LEFT AND RIGHT SIDES OF BODY. NATURAL SIZE. 51, DORSAL TUBERCLE. × 10. 52, GONAD. SIDE ATTACHED TO MANTLE. × 10.

Tentacles of several sizes but arranged with little regularity. Over 20 of them are fairly large; some small ones are also present.

Dorsal tubercle small, its orifice elongated, forming a slightly S-shaped curve.

Dorsal lamina fairly wide; plain edged.

Branchial sac with four well-developed folds on each side, the fourth lower than any of the others. Transverse vessels numerous, somewhat variable in size, but in most parts of the sac little regularity of arrangement other than an alternation of larger and smaller ones is noticeable; the latter generally only cross the stigmata in some parts of their course; in other parts they become stouter and divide them. Internal longitudinal vessels very delicate, narrow, and inconspicuous. The following is an approximation to their arrangement on the left side of one specimen:

dorsal 7 (20) 6 (13) 5 (16) 5 (10) 6 *ventral.*

On the intervals between folds about 4 stigmata intervene between the internal longitudinal vessels in the dorsal region, and about 6 in the ventral region. On the right side of the above specimen a

wide interval (in some places with 12 to 14 stigmata) intervenes between the median dorsal vessel and the first internal longitudinal vessel, and there are but three or four of those vessels dorsal to the base of the first fold. Along each side of the endostyle 10 or 12 stigmata intervene before the last internal longitudinal vessel is reached.

Intestinal loop small but broad and rounded; stomach small and rounded with about 20 rather inconspicuous longitudinal folds in its walls; practically no rectum; margin of anus with many small lobes.

Gonads about a dozen on each side, attached to the mantle in an irregular row near the endostyle. Each gonad is a small oblong sac whose dorsal end is only slightly produced into a neck. The ovary in each is central and elongated and bordered (on the side toward the mantle also overlapped and covered) the rounded or pear-shaped testes. Though the sperm ducts were not traced, a small papilla on the side of the neck of the gonad probably bears the aperture of a duct common to all the testes in the gonad.

Only two specimens (No. 30) (Cat. No. 5933, U.S.N.M.) in the collection, both from station D5536 (off Apo Island, latitude 99° 15′ 45″ N.; longitude 123° 22′ E., 279 fathoms, green mud, Aug. 19, 1909).

In referring these specimens to Herdman's species (three specimens of which were obtained off Ki Island, 129 fathoms, mud) the writer does not overlook two important discrepancies, for Herdman designates the branchial folds as "slight," though the internal longitudinal vessels are numerous and slender, as in the Philippine specimens. Herdman likewise states that there are "apparently" only three or four gonads on each side. This is, of course, subject to individual variation, and as most of the characters and the deep water habitat favor the probability that the two forms are identical, the writer will not undertake to establish a new species for these two small specimens.

PANDOCIA OVATA (Pizon), 1908.

Plate 31, fig. 31.

1908. *Polycarpa ovata* Pizon, Rev. Suisse Zoologique, vol. 16, p. 211, pl. 11, figs. 15–20.

1909. *Pandocia ovata* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1484.

Body oval in outline, strongly compressed from side to side, attached by one end; the apertures (both 4-lobed) on low elevations near together at the other end. Test only moderately thick, opaque, leathery, somewhat pearly inside and of a dirty brown color externally; its outer surface very uneven with coarse elevations and prominences whose surfaces are themselves roughened with minute closely placed wrinkles, but are practically free from incrusting foreign

matter. Height of largest specimen from place of attachment to branchial orifice, 45 mm.; greatest diameter at right angles to the above, 33 mm.; lateral diameter (estimated), 12 mm. or less.

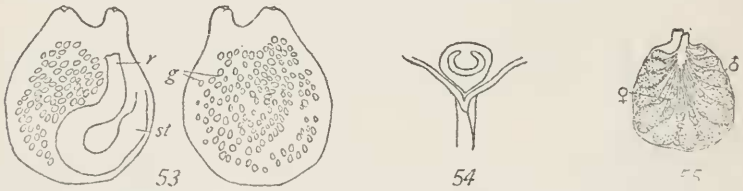
Mantle dark colored, its muscles composed chiefly of separate fibers or small irregular groups of fibers, the deeper and best-developed layer consisting of those radiating from the bases of the siphons or having a similar direction, the less complete superficial muscles crossing them at right angles or obliquely.

Tentacles few: 12 to 16 large ones probably represent two orders, but are not very regularly arranged. Additional smaller ones occur in only a few of the intervals.

Dorsal tubercle large but not prominent; its orifice C-shaped with the open interval forward; horns not inrolled or incurved.

Dorsal lamina plain-edged, broader in the posterior part.

Branchial sac with four well-developed folds on each side separated by rather wide intervals. Transverse vessels of four, in some places



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FIGS. 53–55.—PANDOCIA OVATA (PIZON). 53, LEFT AND RIGHT SIDES OF BODY. × .65. 54, DORSAL TUBERCLE. × 8. 55, GONAD. SIDE NEXT TO BRANCHIAL SAC. × 25.

five, orders quite regularly arranged, the smallest generally crossing the stigmata. Internal longitudinal vessels stout; their distribution in the largest specimen is about as follows:

Right side: *dorsal* 4 (11) 5 (14) 6 (19) 5 (14) 4 *ventral.*
Left side: *dorsal* 4 (10) 5 (15) 5 (18) 5 (13) 4 *ventral.*

They are rather irregularly spaced; in general there are 8 or 10, sometimes 12, stigmata between them on the intervals between folds, but along the median dorsal vessel and endostyle 15 or more.

Intestine of large diameter but forming a rather compact rounded loop within which a very large endocarp is situated. Stomach short and rounded, without conspicuous plications and with a poorly developed pyloric caecum. Rectum abruptly bent forward; rather short; margin of anus with only very rudimentary yet numerous lobes.

Gonads of the typical *Pandocia* type. Each a very small oval or rounded sac with a very short neck, containing a central mass of eggs bordered by a varying but not very large number of pyriform male glands whose ducts converge on the unattached side of the gonad toward the base of a papilla situated beside the neck of the gonad. They unite and discharge by a common orifice at the summit of this

papilla. The gonads are exceedingly numerous (100 or more on a side), are distributed singly or in regular rows or groups over the inner surface of the mantle on most of the right side and the part of the left side not occupied by the digestive tract.

This species was obtained at the following two stations only:

No. 24. Station D5144 (off Jolo Light, 19 fathoms, coral sand, Feb. 15, 1908). One specimen (Cat. No. 5935, U.S.N.M.), to which a very immature ascidian, perhaps a young individual of this species, was attached.

No. 150. Station D5149 (off Sirun Island, Sulu Archipelago, 10 fathoms, coral and shells, Feb. 18, 1908). One specimen. (Cat. No. 602 F, U.S.N.M.)

This is a very typical species of the genus *Pandocia*. It was described by Pizon (1908) from Amboina and is very closely allied to, if distinct from, *Pandocia stephenensis* Herdman, 1899, from Port Jackson, Australia. It is also allied to *P. obtecta* (Traustedt), 1883 (syn. *Polycarpa multiphiala* Verrill, 1901) of the West Indies and Bermuda (see Van Name, 1902), but is distinguished from the last by fewer internal longitudinal vessels on the folds and especially by the very much more numerous and smaller and more rounded gonads, which contain fewer eggs and fewer testes than in those of the West Indian form.

A specimen of *Pandocia pedata* from station D5640 (off Labuan Blanda Island, Buton Strait, Dec. 13, 1909, 24 fathoms, sand and broken shells) has several very young ascidians (No. 73) attached to its surface. They are of flattened form attached by the whole ventral surface, and have four well-developed branchial folds on each side, rather numerous internal longitudinal vessels, and a longitudinally plicated stomach with a rudimentary caecum. Immature gonads of the usual *Pandocia* type were distinguished in the largest individual, which was only about 2.5 mm. long. The specimens, though perhaps of the present species, are too immature for satisfactory identification in the present state of our knowledge of the ascidians of this region.

Genus POLYANDROCARPA Michaelsen, 1904.

POLYANDROCARPA MAXIMA (Sluiter), 1904.

Plate 31, fig. 33.

1904. *Gynandrocarpa maxima* Sluiter, *Siboga*-Exped., vol. 56*a*, p. 93, pl. 15, figs. 5–7.

1909. *Polyandrocarpa maxima* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1370.

The only specimen consists of a compact cluster of about nine individuals growing one upon the other and so completely fused into an irregular oval mass that it would be taken for a single large ascidian were it not for the many apertures (which are 4-lobed and

each raised on small, rough, sharply defined papilla) that are scattered over the surface. Test tough, yellowish white, opaque, and moderately thick in some places, but in the interior only thin laminae generally separate adjacent individuals. The surface, though with some wrinkles, is in many places fairly smooth, but never shiny, and is nearly free from incrusting materials. Size of entire cluster 28 mm. by 21 mm. The individuals are of different sizes, the largest 17 mm. long, but it is not unlikely that they are all somewhat immature. The following details were made out in the larger individuals:

Apertures widely separated. Mantle thin and delicate, its musculature slight.

Tentacles of 3 sizes quite regularly arranged; normal total number probably 32.

Dorsal tubercle oval, broader than long, with a transversely elongate aperture which forms a complete oval except for a very small open interval on the forward side.

Dorsal lamina plain-edged.

FIGS. 56, 57.—POLYANDROCARPA MAXIMA (SLUITER). 56, LEFT AND RIGHT SIDES OF BODY OF ZOOID. × 1.5. 57, GONAD. SIDE NEXT TO BRANCHIAL SAC. × 36.

Branchial sac with four well developed folds on each side, which are separated by wide intervals. Transverse vessels of three orders fairly regularly arranged, the smallest crossing the stigmata. Internal longitudinal vessels distributed about as follows on the right side of a large individual.

dorsal 4 (13) 5 (16) 5 (16) 4 (11) 6 *ventral.*

They are generally separated by from four to six stigmata on the intervals between folds.

Stomach short and rounded with a varying number (about 15 to 20) of longitudinal folds, but no caecum worthy of a name, though a slight protuberance exists in its place. Intestinal loop forming a more or less rounded curve of varying width, then bending abruptly forward to the rather short rectum. Margin of anus two-lipped.

Immature reproductive organs were found in two of the larger individuals, and consisted of a few (not over five or six) oval or flask-shaped gonads on the inner surface of the mantle on each side of the body. They each contain an ovary in the part lying against the branchial sac and a double row of testes in the part next to the mantle, the sperm ducts embracing the ovary and uniting to form a common duct which lies upon the free surface of the ovary and ends on a papilla beside the ovarian opening in the usual manner.

Locality of the only specimen, No. 46 (Cat. No. 5959, U.S.N.M.): Station D5141 (off Jolo Light, 29 fathoms, coral sand, Feb. 15, 1908).

The type and only specimen of Sluiter's species was from Salibabu Island (reef). According to his description the internal longitudinal vessels are considerably less numerous than in the Philippine specimen; possibly he may have made the count on a smaller and less mature zooid.

Genus EUSYNSTYELA Michaelsen, 1904.

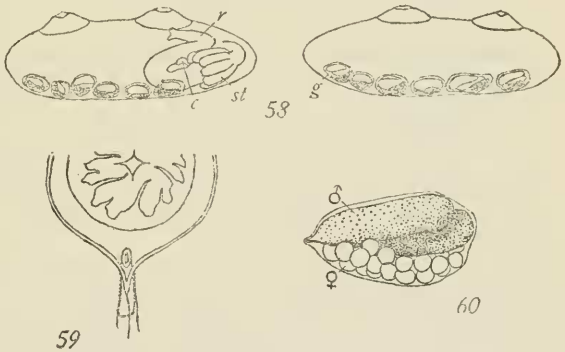
EUSYNSTYELA LATERICIUS (Sluiter), 1904.

Plate 26, fig. 9.

1904. *Gynandrocarpa latericius* SLUITER, *Siboga*-Exped., vol. 56*a*. p. 94, pl. 15, figs. 8–11.

1909. *Polyandrocarpa latericius* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1370.

Colony flat and expanded, averaging about 3 mm. thick, the upper surface fairly smooth and free from adhering material, but raised into low, distinctly bordered, rounded elevations of elliptical outline when seen from above. Each of these elevations, which are usually quite close together, is caused by the body of a zooid and bears upon its surface the two apertures of the zooid, which are raised on low flattened conical papillae, the branchial near the anterior end of the zooid, the atrial far back on the dorsal surface. The branchial aperture is distinctly square, the atrial is more nearly round.



FIGS. 58–60.—EUSYNSTYELA LATERICIUS (SLUITER). 58, LEFT AND RIGHT SIDES OF BODY OF ZOOID. × 6. 59, PART OF THE CIRCLE OF TENTACLES AND DORSAL TUBERCLE. × 15. 60, GONAD. × 19.

Dimensions of the largest colony 108 mm. by 51 mm.; length of body of largest zooids 6.5 mm., width 3.5 mm.

Test very tough and leathery; yellowish white, thick between and beneath the zooids, but thin over them. Under magnification minute furrows are visible on the portion over the zooids, some radiating from the apertures, others having a elliptical course parallel and concentric with the outline of the body. Owing to the tough character of the test, vascular connections between the zooids, though doubtless present, were not successfully traced.

Mantle moderately thick; its muscles are not gathered into conspicuous bands.

Tentacles apparently normally 16, of two sizes placed alternately. At their bases an annular membrane extending around the whole circle unites them all together. Atrial tentacles are present, but are so minute and slender as to easily escape notice. They are arranged in a large circle. Peculiar thread-like appendages of the inner wall of the mantle in the atrial region have been described by Sluiter (1914) in this species, and are present in the Philippine specimens also.

Dorsal tubercle elliptical, with the long diameter placed longitudinally; its orifice of similar outline, also with its long diameter longitudinal.

Dorsal lamina plain-edged.

Branchial sac with four distinct folds on each side and numerous internal longitudinal vessels. Their distribution in a large zooid was found about as follows:

Right side: *dorsal* 2 (14) 4 (8) 4 (13) 3 (6) 2 *ventral.*
Left side: *dorsal* 2 (13) 4 (9) 3 (12) 4 (7) 2 *ventral.*

Transverse vessels of nearly uniform size. Only 2 to 3 stigmata generally intervene between internal longitudinal vessels on the intervals between folds, but a larger number occur between the endostyle and last vessel, and 8 or 10 stigmata are often present between the median dorsal vessel and the first internal longitudinal vessel, especially on the right side of the body. Stigmata oblong or elliptical, often rather wide.

Esophagus short and curved; stomach short with few (about 19) longitudinal folds and a small curved pyloric caecum. Intestine large, running forward from the stomach, then bending back along its side. The rectum is only moderately long, and begins with a sharp forward bend of the intestine. Its orifice is two-lipped.

Gonads rounded or oval sacs, each normally containing a considerable number of eggs and two large oval or sausage-shaped testes. These gonads may number a dozen or more on each side of the body and are placed in an irregular row each side of the mid-ventral line, attached to the inner surface of the mantle.

The larger of the two colonies (No. 124), (Cat. No. 5977, U.S.N.M.), is from station D5557 (near Cabalian Point, Jolo Island, 13 fathoms, sand and coral. September 18, 1909). The other (No. 137) (Cat. No. 5976, U.S.N.M.), nearly as large, is also from Jolo Island, February 11, 1908. The Philippine specimens have the longitudinal vessels more numerous and have somewhat smaller zooids than Sluiter's type, which was from Sarassa Island, 36 meters. The writer has in no case found more than two testes in a gonad

and therefore places the species in the genus *Eusynstyela* Michaelsen, 1904, instead of *Polyandocarpa*. *Eusynstyela imthurni* (Hardman), from Ceylon (Herdman, 1906, p. 330, pl. 7, figs. 1–9; pl. 9, fig. 4), is evidently a very closely allied form.

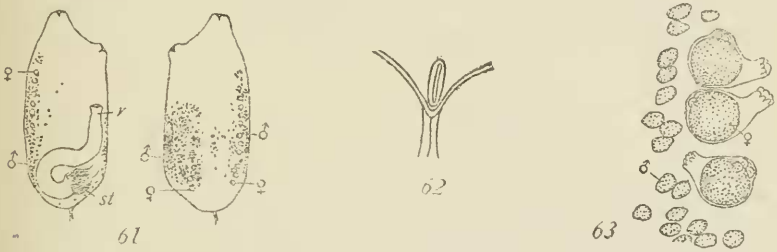
Genus STOLONICA Lacaze-Duthiers and Delage, 1892.

While the following species does not conform strictly to the generic diagnosis given by Hartmeyer (1909) in respect to the arrangement of its gonads, the difference does not seem to warrant separating it from that genus.

STOLONICA STYELIFORMIS, new species.

Plate 29, figs. 17–19.

Zooids oblong or somewhat cylindrical, tapering rather abruptly at the anterior end, attached by the posterior end, the apertures (both four-lobed) on rather prominent papillæ, the branchial at the an-



FIGS. 61–63.—STOLONICA STYELIFORMIS, NEW SPECIES. 61, LEFT AND RIGHT SIDES OF BODY OF ZOOID. × 1.5. 62, DORSAL TUBERCLE × 15. 63, GONADS. × 12.5.

terior end and the atrial a little way back on the dorsal side. Colony consisting of a more or less dense cluster of zooids, which, though attached to the object on which they grow by the posterior end only, are often so crowded together that the posterior parts of their bodies are in close contact and adhere together, but they do not fuse, and can be torn apart without injuring the test. The anterior part at least of the body of each zooid is free and separate from adjacent zooids. The largest specimen (No. 130), (Cat. No. 5995, U.S.N.M.), though evidently only a part of a colony, completely surrounds a section of the stem of an alcyonarian for a length of about 60 mm. and consists of about 100 closely placed zooids, mostly of fairly uniform size (14 mm. to 16 mm. long and 6 mm. to 7 mm. in dorsoventral diameter). Another colony (No. 113) is similar but more irregular, and has zooids of less uniform size. In neither of these colonies are the zooids mature. In specimens from stations D5174 and D5555 the zooids are larger, sometimes reaching 23 mm. or more in length, and are fully adult. They are generally less closely crowded, their bodies being separate for the whole length; the posterior end is often narrowed into a short pedicel-like extension

whose expanded base is continuous with that of adjacent zooids. Connection between the zooids of the colony is by vascular processes from the posterior end of the body and appears to persist under normal conditions in fully adult zooids.

Test not thick but tough and opaque, of a brownish color externally, becoming purplish brown about the apertures. In the zooids from station D5174 this purplish color is distributed in about four broad stripes radiating from the branchial aperture and extending some distance back. External surface rather rough, somewhat wrinkled and slightly incrusted with foreign material; internal surface with a thin whitish, slightly pearly layer.

Mantle moderately thick, adherent to the test; its muscles fairly well developed but not gathered into conspicuous bands. Individual fibers or slender groups of a few fibers form a network with small more or less rectangular meshes.

Tentacles about 32; of three sizes arranged with some regularity.

Dorsal tubercle much elongated longitudinally, with a slitlike or long oval orifice.

Dorsal lamina plain-edged.

Branchial sac with but two folds on each side separated by rather wide intervals. The grouping of the internal longitudinal vessels does not appear to indicate other rudimentary folds. The branchial sac is not symmetrical, being more expanded and with more numerous internal longitudinal vessels on the right than on the left side. Transverse vessels rather widely spaced, of 2 sizes placed alternately, the smaller crossing the stigmata which are rather long. Internal longitudinal vessels numerous and slender, separated by about three or four stigmata on the intervals between folds. In a large zooid their distribution was found as follows:

Right side: *dorsal* 9 (16) 9 (14) 9 *ventral.*
Left side: *dorsal* 6 (15) 9 (12) 7 *ventral.*

In another individual:

Right side: *dorsal* 5 (17) 8 (14) 9 *ventral.*
Left side: *dorsal* 3 (14) 7 (12) 9 *ventral.*

Stomach short and rounded, with 20 to 25 longitudinal plications but no caecum. Intestine of large diameter, but forming a rather small loop. Rectum long. Margin of anus smooth or nearly so.

Reproductive organs were found only in the specimens from stations D5174 and D5555. These also contain large tailed larvæ in the peribranchial cavity. Only the ovaries form compact gonads, each gonad consisting of a group of a very few eggs (but one of which appears to become very large at a given time) inclosed in a small sac having a large irregularly lobed opening produced into a papilla or very short oviduct. These female gonads, which average

20 to 30 in total number in large zooids, are distributed in the two rows, one on each side of the mid-ventral line. The row on the right side is the longest, not only extending nearly to the posterior end of the body, but at that point curving dorsally and extending a little way forward in the dorsal region of the right side. The row on the left side does not, ordinarily at least, reach near to the posterior end of the body. The testes are not grouped into distant gonads; they are small rounded or pear-shaped glands, not cleft into lobes, and are very numerous, being distributed in groups, irregular rows, or singly on the inner surface of the mantle. They are most abundant on the posterior dorsal region, chiefly but not entirely to the right of the mid-dorsal line. They are also very abundant in the ventral region, among or alongside of the female gonads. A few are scattered in other places, especially on the right side of the body, and in continuation forward or backward of the rows of female gonads. The sperm ducts are difficult to trace, but it is evident that those of testes lying near together in a group often join to form common ducts.

The specimens are from the following localities:

No. 130. Station 5134 (off Balukbaluk Island. Sulu Archipelago, 25 fathoms, fine sand, Feb. 7, 1908). Large colony; no reproductive organs found in zooids. (Cat. No. 5995, U.S.N.M.).

No. 113. Station D5136 (near Jolo Light, 20 fathoms, sand and shells, Feb. 14, 1908). Large colony; no reproductive organs found in zooids. (Cat. No. 5994, U.S.N.M.).

No. 121. Station D5174 (off Jolo Light, 29 fathoms, coarse sand. Mar. 5, 1908). Type colony. (Cat. No. 6042, U.S.N.M.)

No. 17. Station D5555 (off Capalian Point. Jolo, 34 fathoms, coarse sand. Sept. 18, 1909). (Cat. No. 5996, U.S.N.M.).

In the distribution of the gonads this species differs somewhat from those thus far included in the genus *Stolonica*. It might be placed in the genus *Heterocarpa* Lacaze-Duthiers and Dalage (1892) as modified and defined by Michaelsen (1911) with but little alteration of his diagnosis except that the existence of budding and the formation of true colonies is uncertain in the species thus far placed in *Heterocarpa*. The writer can not feel any doubt of it in the case of the present species; moreover if compound species are admitted to *Heterocarpa* the chief reason for maintaining it as a distinct genus disappears.

STOLONICA VESICULARIS, new species.

Plate 32, fig. 39.

The colony or colonies in the only specimen almost entirely cover the surface of the body of a large simple ascidian (*Microcosmus exasperatus* Heller). The zooids are rounded and sac-like, sometimes higher than wide, and attached by the posterior end, but only

slightly, so that they are easily broken away. The two small 4-lobed or square apertures are near together on the part of the body opposite the area of attachment and are slightly prominent. The colony contains individuals of various sizes and ages; from very immature and minute ones up to those having a diameter of 3 mm. to 4 mm. In some parts of the colonies the individuals are quite crowded, so that their form is more or less modified by the pressure of the adjacent ones, but the connection between them, especially in the case of the larger ones, is but slight and is by means of slender root-like processes of the ventral region in which small vessels run. Test thin, parchment-like and slightly translucent, its surface somewhat rough and thinly incrusted with sand in the larger individuals. Its color is yellowish, sometimes tinged with purplish brown about the apertures.

Mantle thin, adherent to the test, its musculature not greatly developed. Transverse and longitudinal fibers are numerous but are not for the most part gathered into bands.

Tentacles apparently normally 16, of two sizes placed alternately.

Dorsal tubercle small; oval with its long diameter transverse to the body axis. Its orifice is a straight or slightly curved slit likewise transverse to the body axis.

Dorsal lamina plain-edged.

First fold of the branchial sac well developed on each side of the body, especially on the right side. On the left side it is more prominent in the posterior region. One or two additional rudimentary or vestigial folds, indicated chiefly or entirely by a somewhat closer grouping of the internal longitudinal vessels, are recognizable in large zooids, showing more distinctly on the right than on the left side of the body. The scheme of the internal longitudinal vessels was found as follows in a large zooid:

Right side: *dorsal* 5 (25) 4 (5) 6 (7) 8 *ventral.*
Left side: *dorsal* 4 (23) 5 (4) 10 *ventral.*

Internal longitudinal vessels closely placed especially on the large folds; even on the intervals they are separated only by the width of two stigmata or even less. The stigmata are rather wide. Transverse vessels of two (in some places three) sizes, the smallest crossing without interrupting the stigmata.

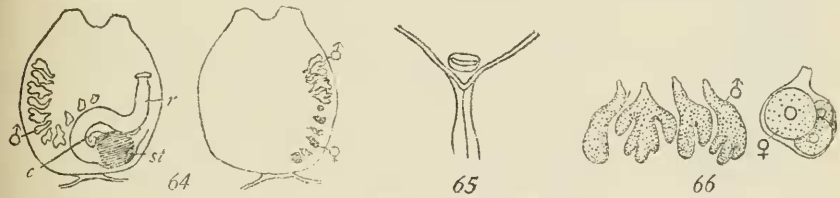
Stomach short and wide with numerous (in large zooids about 30) narrow longitudinal folds in its walls, and a rather long but slender curved pyloric caecum. Intestine forming a rather compact rounded loop; rectum moderately long, the intestine making a considerable bend where the rectum commences. Margin of anus smooth with a thickened border.

Ovaries few (about five to seven) situated on the right side along and close to the posterior part of the endostyle. They are small

sacs, each containing a few eggs which are apparently discharged by an orifice on a neck too short to be termed an oviduct. Testes more numerous (15 to 20) than the ovaries; they are rather large and are generally cleft into several lobes, sometimes of quite irregular outline. They are mostly arranged in a row on the left ventral region; just anterior to the intestinal loop this row bends dorsally and forward for a little distance. A few of the testes are situated on the right side along the endostyle, continuing forward the row of female gonads. In a few cases hermaphroditic gonads, each containing a testis and a small group of eggs, were found replacing one or two of the female gonads.

The type and only specimen (No. 135) (Cat. No. 6034 U.S.N.M.) is from station D5145, off Jolo Light, 23 fathoms, coral sand and shells, February 14, 1908.

This species is closely allied to *S. socialis* Hartmeyer, 1903 (see also Michaelsen, 1904), of the northwestern European coasts. In



64 65 66

FIGS. 64–66.—STOLONICA VESICULARIS, NEW SPECIES. 64, LEFT AND RIGHT SIDES OF BODY OF ZOOID. × 6. 65, DORSAL TUBERCLE. × 20. 66, GONADS. × 20.

that species, however, gonads with ovaries only do not occur, and the posterior part of the row of gonads on the right side is composed entirely of hermaphroditic gonads. Other minor differences also, as well as the geographical separation and different climatic conditions of the localities of the two forms make it appear necessary to regard this as a new species.

Family BOTRYLLIDAE Verrill, 1871.

Genus BOTRYLLOIDES Milne-Edwards, 1841.

BOTRYLLOIDES TYREUM Herdman, 1886.

1886. *Botrylloides purpureum* HERDMAN (not v. Drasche, 1883), Rep. Voy. *Challenger*, vol. 14, Tunicata, p. 41. Name changed in same work (pp. 344 and 381) to *B. tyreum;* pl. 1, figs. 1–3; pl. 2, figs. 1–11. Not *Sarcobotrylloides purpureum* Herdman, 1891 (see Herdman, 1889, p. 104).

1891. *Botrylloides tyreum* HERDMAN, Journ. Linn. Soc. London, Zool., vol. 23, p. 608.

1898. *Botrylloides tyreum* GOTTSCHALDT, Abhandl. Senckenb. Gesell., vol. 24, p. 642.

1904. *Botrylloides tyreum* SLUITER, *Siboga*-Exped., vol. 56*a*, p. 101.

1909. *Botrylloides tyreum* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1380.

In the only well-preserved specimen in the collection the colony is thin and expanded, surrounding a piece of branching coral for a length of about 40 mm. The coral polyps protrude through openings piercing the colony, which does not appear to exceed 3 mm. in thickness at any point. Test translucent and pale purplish in color; the zooids, which are arranged in complex branching systems, are darker purple.

Zooids rather elongate, attaining a length of about 2 mm. to 2.5 mm. when moderately contracted. Branchial aperture with 6 bifid lobes. Atrial aperture large and commonly produced into a short tube of large diameter, the anterior margin of which is often extended to form a languet of considerable length, but there is great individual variation in this respect.

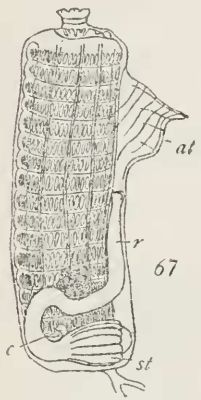


FIG. 67.—BOTRYLLOIDES TYREUM HERDMAN. ZOOID. × 20.

Eight tentacles (four large and four small, placed alternately) are readily distinguishable; the existence of additional third order tentacles is probable.

Branchial sac long, with 15 to 16 rows of stigmata in some zooids, in others somewhat fewer; about 23 stigmata in a row on each side. Three internal longitudinal vessels on each side, spaced apart about the width of five stigmata. Eight or nine stigmata, however, intervene between the last internal longitudinal vessel and the endostyle.

Stomach with about 10 or 11 rather narrow longitudinal folds and a small caecum. (No caecum is mentioned or figured by Herdman, 1886.) Anus slightly 2-cleft.

Testes few in the zooids examined. Some of the zooids contain a single large egg on one or both sides of the body anterior to the testes.

The well-preserved colony (No. 127) (Cat. No. 6031, U.S.N.M.) mentioned above is from station D5144 (off Jolo Light, Feb. 7, 1908, 19 fathoms, coral sand). A small, poorly preserved specimen (No. 67) (Cat. No. 5907, U.S.N.M.), apparently of the same species, is from station D5146 (near Sulade Island, Sulu Archipelago, Feb. 16, 1908, 24 fathoms, coral sand and shells).

The type of this species was obtained by the *Challenger* Expedition in latitude 11° 37′ N.; longitude 123° 31′ E., 18 fathoms. Gottschaldt (1898) records a small colony from Ternate, and the *Siboga* Expedition (see Sluiter, 1904, p. 101) obtained it at several other localities on reefs in the Malay region.

Family RHODOSOMATIDAE Hartmeyer, 1908.

In addition to the two genera of this family at present known from the Philippine region, *Corella* Alder and Hancock, 1870, will doubtless eventually be found there, as it occurs elsewhere in the Malay Archipelago and in Japan.

Genus RHODOSOMA Ehrenberg, 1828.

RHODOSOMA PAPILLOSUM (Stimpson), 1855.

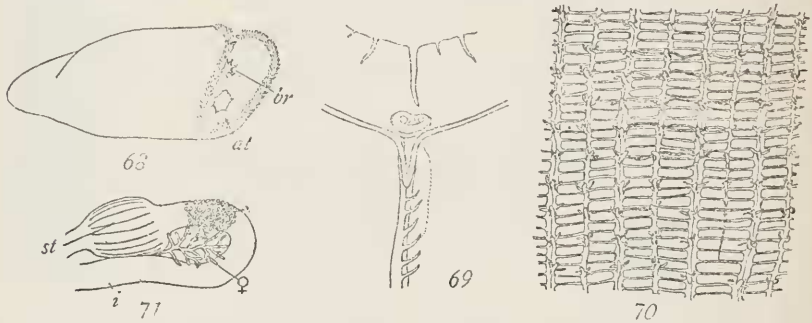
1855. *Schizascus papillosus* Stimpson, Proc. Philadelphia Acad. Sci., vol. 8, p. 377.
1885. *Rhodosoma papillosum* Traustedt, Vidensk. Meddel. Nat. For. Kobenhavn, ann. 1884, p. 9.
1891. *Rhodosoma papillosum* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 598.
1901. *Rhodosoma papillosum* Hartmeyer, Archiv. f. Natur-geschichte, vol. 67, suppl., pp. 158 and 161, pl. 4, figs. 2, 9–11.
1904. *Rhodosoma papillosum* Sluiter, *Siboga* Exped., vol. 56*a*, p. 26, pl. 1, fig. 2; pl. 4, figs. 4–6.
1906. *Rhodosoma papillosum* Hartmeyer, Zool. Anzeiger, vol. 31, p. 25.
1906. *Rhodosoma papillosum* Herdman, Ceylon Pearl Oyster Fisheries, Supplementary Report No. 39, p. 302.
1907. (*Rhodosoma*) *papillosum* Seeliger, Bronn's Tier-reich, vol. 3, suppl., p. 1077.
1909. *Rhodosoma papillosum* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1390.

Body rounded at one end, broader and obliquely truncated at the other, and attached by a large part of the right side. The truncated end of the body is formed into a valve or cover hinged at the attached side and separated from the main portion of the body by a deep mouth-like cleft lined with thin flexible test; the test elsewhere is thicker and more rigid. The two apertures are situated in the flexible test in the cleft and the valve or cover can close tightly against the main part of the body, shutting off the apertures from the exterior and entirely concealing them. Branchial aperture with 7 to 9 lobes; atrial aperture with 6 less conspicuous lobes. Test on body and cover tough and fairly rigid, colorless and transparent, with a smooth clean external surface in most of the specimens, except that the margins or lips of the mouth-like cleft are studded with numerous minute conical elevations, each bearing a short spine. The spines are sometimes provided with one or more short lateral projections. One specimen, however (that from station D5139), had the body surface somewhat incrusted with foreign material. Dimensions of two largest specimens (valve closed), 42 mm. by 29 mm. and 32 mm. by 22 mm., respectively.

Mantle thin, not adherent to the test in preserved specimens except in the region of the apertures. Musculature very slight or almost wanting on most parts of the body, but slender bands radiate from the apertures and generally unite in groups to form larger bands. These, however, do not extend far from the apertures except those near the two angles of the mouth-like cleft. There the bands are long and stout and closely grouped, and serve to move the valve or cover.

Tentacles simple, rather small and widely spaced, about 32 in number of 3 orders rather regularly arranged; in addition there are a few fourth-order tentacles in some parts of the circle. (This count was made in one of the largest specimens.)

Dorsal tubercle C-shaped with strongly incurved horns; the open interval directed forward.



FIGS. 68–71.—RHODOSOMA PAPILLOSUM (STIMPSON). 68, EXTERNAL VIEW. × 1.25. 69, DORSAL TUBERCLE, PART OF DORSAL LAMINA, AND PART OF THE CIRCLE OF TENTACLES. × 16. 70, PART OF BRANCHIAL SAC. × 15. 71, STOMACH, PART OF INTESTINE, AND GONADS AS SEEN THROUGH MANTLE. × 2.5.

Dorsal lamina represented by a series of small, rather slender languets.

Branchial sac without folds or minute plications. Transverse vessels very numerous, of two sizes placed alternately in most parts of the sac, but in some places nearly uniform in size. The intervals between the transverse vessels are divided by very numerous slender longitudinal vessels into rather narrow stigmata. At intervals of 3 or 4 stigmata small curved papillae arise from the transverse vessels and support slender internal longitudinal vessels. They project a trifle beyond their point of union with the internal longitudinal vessels. The latter in large and old individuals are mostly incomplete and interrupted between the supporting papillae so that they form merely lateral branches of these papillae. (See fig. 70.) In one of the smaller and doubtless much younger individuals the internal longitudinal vessels were found to be much less reduced and were practically complete over considerable areas in some parts of the sac. Here and there one of the transverse vessels tapers off

and ends, first becoming very slender and merely crossing without terminating the stigmata; the supporting papillae that bear it become correspondingly reduced, and finally disappear as the vessel terminates.

Digestive tract on right side of body. Stomach rather short and rounded, with conspicuous longitudinal folds in its walls. Intestine having the peculiar course characteristic of the family, passing ventral instead of dorsal to the stomach. Margin of anus with small inconspicuous lobes.

Reproductive organs present on the right side of the body only. The ovary is a many-branched organ lying within the intestinal loop, its branches spreading out to a slight extent on the surface of the loop next to the mantle. Testis not developed in specimens examined. In this genus it is of ramified form, spreading over the surface of the intestinal loop.

The localities of the specimens in the collection are:

No. 77. Station D5250 (off Linao Point, Gulf of Davao, May 18, 1908, 23 fathoms, coral sand) (Cat. No. 5964, U.S.N.M.).

No. 69. Station D5139 (near Jolo Light, Feb. 14, 1908, 20 fathoms, coral sand). Large individual somewhat incrusted with foreign material (Cat. No. 5963, U.S.N.M.).

No. 93. Station D5145 (near Jolo Light, Feb. 14, 1908, 22 fathoms, sand and shells (Cat. No. 5963, U.S.N.M.).

No. 195. Station D5137 (near Jolo Light, Feb. 14, 1908, 20 fathoms, sand and shells), (Cat. No. 5993, U.S.N.M.).

No. 88. Station D5147 (Sulu Archipelago, near Siasi, Feb. 16, 1908, 21 fathoms, coral sand and shells). Very small and immature individual (Cat. No. 5930, U.S.N.M.).

This species, originally described from Chinese waters (Stimpson, 1885), appears to be widely distributed in the warmer parts of the western Pacific and in the Malay Region, and probably ranges still more widely, for *Rh. ceylonicum* Herdman (1906) from Ceylon, and *Rh. huxleyi* MacDonald (1862) from Australia,[1] do not appear to be separated from it by any characters of importance. It was obtained at many stations in the Malay Region by the *Siboga* Expedition, 118 meters being the greatest depth. The reader is referred to the article by Hartmeyer (1901) for a discussion of the species of this genus up to that date: also to Herdman, 1906, pages 302 and 303. The writer follows in the present paper all recent authors in employing the name *papillosum* for this species, but does not lose sight of the fact that Stimpson's *Rh. pellucidum*, also from China, which as Hartmeyer (1901, p. 161) suggests, is very probably identical with *papillosum*, is described as species No. 19 of Stimpson's article (1855) while *papillosum* is described as No. 20 of the same article. In case the identity of the two forms can be proved

[1] See Willey, 1902, p. 711, fig. 11.

the name *pellucidum* will have priority. The settlement of this question will probably have to wait until future collecting shall determine whether one or two species of this genus occur in Chinese waters.

Family PHALLUSIIDAE Traustedt, 1882.

[=ASCIDIIDAE Authors.]

Genus PHALLUSIA Savigny, 1816. [=ASCIDIA Authors.]

PHALLUSIA DEPRESSIUSCULA (Heller), 1878.

Plate 27, figs. 10–13.

1878. *Ascidia depressiuscula* Heller, Sitzungsber. d. k. Akad. Wiss. Wien, vol. 77, p. 87, pl. 1, fig. 7.

1891. *Ascidia depressiuscula* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 594.

1906. *Ascidia depressiuscula* Herdman, Rep. Ceylon Pearl Oyster Fisheries, pt. 5, suppl. rep. No. 30, p. 305, pl. 2, figs. 10–22.

1909. *Phallusia depressiuscula* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1402.

Body usually much flattened from side to side, attached by an area on the posterior part of the left side or by a large part of that side, but the area of attachment is subject to some variation in position. Body as seen from the side generally more or less elongate, sometimes nearly oval in outline, but more often narrowed anteriorly, or tapering in such a manner that the branchial aperture appears to be borne on a rather long tube or siphon, though in reality this is the narrowed anterior part of the branchial sac. Branchial aperture terminal; atrial aperture on a tube of varying length arising a considerable distance back on the dorsal border of the body, and pointing dorsally or more or less forward, occasionally almost directly forward and parallel to the narrow anterior part of the body.

Dimensions of largest specimens:

No. 114 (Cat. No. 6025, U.S.N.M.), Station D5555, length 110 mm., dorso-ventral diameter 47 mm.

No. 154 (Cat. No. 6021, U.S.N.M.), Endeavor Point. Length 102 mm., dorso-ventral diameter, 52 mm.; thickness from side to side about 14 mm.

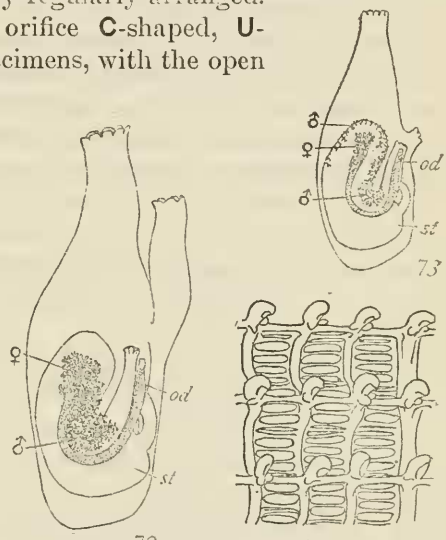
Test usually moderately thick on most parts of the body, of a cartilaginous appearance and rather firm consistency. Sometimes it is almost colorless and fairly clear with a glassy luster, in other individuals suffused with a smoky brown color over most of the body or near the apertures only. The test is easily torn or broken. Its external surface is usually fairly smooth and free from foreign matter; it may be very even, or have a few irregular furrows or depressions and elevations.

Mantle thin, but with numerous muscle fibers disposed singly or in narrow bands or loose groups. On the anterior part of the body the deeper ones are mostly transverse and overlaid with longitudinal ones, these also being separate or only gathered into very narrow bands. The transverse fibers become more widely spaced and less regularly disposed (running in various oblique directions) on the middle and posterior regions of the body, and the musculature practically disappears on the posterior part of the left side.

In one of the largest specimens about 48 tentacles were counted; they are of three orders, not very regularly arranged.

Dorsal tubercle simple, its orifice C-shaped, U-shaped, or V-shaped in most specimens, with the open interval forward or to the right and the horns curved inward (rarely outward), but not spirally coiled. Ganglion a considerable distance back from the dorsal tubercle.

Dorsal lamina with lateral ribs, narrow and plain-edged in the anterior part, wider and provided with small but not very regular slender teeth farther back. It passes to the left of the esophageal orifice, becoming much lower after passing the orifice, though in some specimens it can be traced a considerable distance farther back. Another membrane, also more or less denticulate, arises from the space just anterior to the esophageal orifice and is continued parallel to the dorsal lamina past the orifice on the right side and for some distance back. The papillæ along the right side of the area surrounding the esophageal opening (described by Heller, 1878, p. 87), were also observed in the *Albatross* specimens. They represent the supporting papillae of the most dorsal internal longitudinal vessel of the right side; this vessel is, however, rudimentary or wanting, and the papillae are larger and longer than usual.



FIGS. 72–74. — PHALLUSIA DEPRESSIUSCULA (HELLER). 72, LEFT SIDE OF BODY. ONE-HALF NATURAL SIZE. 73, LEFT SIDE OF BODY OF ANOTHER INDIVIDUAL. × .75. 74, PART OF BRANCHIAL SAC. × 15.

Branchial sac extending far back beyond the mouth of the esophagus. Transverse vessels numerous; in some individuals three or four orders arranged with considerable regularity may be recognized on most parts of the sac; in others, though large vessels occur at intervals, the vessels of the smaller orders are in most places nearly

of uniform size. The minute plication of the wall of the sac characteristic of most members of the genus is fairly well developed, but the large transverse vessels take no part in it. The plications vary from about half as numerous to nearly as numerous as the internal longitudinal vessels. Internal longitudinal vessels numerous, separated in one of the largest specimens by five or six stigmata in the narrow anterior part of the sac, but farther back where the sac becomes wider by a larger number, often 10 or 11. In smaller individuals the average number of stigmata intervening between such vessels is generally somewhat less. At the intersection with transverse vessels, but not at intermediate points, the internal longitudinal vessels bear curved papillæ, which have a membrane along the concave border and generally a pair of small rounded projections at the base. The internal longitudinal vessels are often incomplete or interrupted between some of the transverse vessels.

Digestive tract large and covering an extensive area on the left side of the body, though its parts are compactly disposed, the rectum ascending quite close along the descending or posteriorly extending part of the intestinal loop. Margin of anus more or less distinctly plicated.

Ovary composed of a mass of rather stout convoluted tubules. It is partly visible through the mantle, lying in the bend of the anterior part of the intestinal loop, a few of the tubules usually spreading out upon that surface of the intestine which lies next to the mantle. From the ovary the large stout oviduct (usually closely packed with eggs) accompanies the terminal portion of the intestine lying upon it (as seen through the mantle) or along its dorsal border and terminates near the anus.

The male organ consists of an immense number of small irregularly distributed glands of simple though irregular shape, connected by a system of branching ducts leading to a common sperm duct accompanying the oviduct. Though the organ lies largely between the digestive tract and branchial sac, parts of it come out upon that surface of the stomach and intestine lying next to the mantle through the interval within the curves of the digestive tract, and generally also by reaching around the outer border of the anterior part of the intestinal loop.

Judging from its representation in the collection, this is one of the commonest and most widely distributed ascidians in the Philippine region. The specimens were collected on the reefs and in shallow water (greatest depth 34 fathoms). They agree well with Heller's (1878) original description and figure based on a specimen from Ceylon, but there is considerable variation, especially in external form and appearance, between different specimens of the series collected by

the *Albatross* Expedition, as would indeed be expected, since they are of various sizes and ages, and come from different localities. With Herdman's (1906) description of specimens from Ceylon there are some discrepancies, notably in the more numerous tentacles, the spirally coiled horns of the dorsal tubercle and in the occasional presence of intermediate papillae on the internal longitudinal vessels which he mentions. The first two differences may easily be attributed to individual variation, but no intermediate papillae were found in the Philippine specimens and would hardly be expected to occur as an individual peculiarity. Herdman mentions the presence of "intermediate horizontal membranes crossing the meshes in places." These can be nothing but rudimentary transverse vessels, and the small papillae may have belonged to such vessels. In most specimens some of the transverse vessels do not extend entirely across the sac, but taper off and become rudimentary and finally disappear without extending the entire distance.

The localities of the Philippine specimens are:

No. 125. Station D5360 (off Corregidor Light, Feb. 7, 1909, 12 fathoms, hard bottom). One specimen (Cat. No. 6024, U.S.N.M.).

Nos. 89, 94, 122. Catbalogan, Samar, April 15 and 16, 1908. Nine specimens in all. (Cat. Nos. U.S.N.M., 5947, 5943, and 6026, respectively.)

No. 154. Endeavor Point, December 24, 1908. One large specimen (Cat. No. 6021, U.S.N.M.).

No. 99. Station D5254 (off Linao Point, Gulf of Davao, May 18, 1908, 21 fathoms, sand and coral). One specimen (Cat. No. 6023, U.S.N.M.).

No. 70. Station D5141 (off Jolo Light, Feb. 15, 1908, 29 fathoms, coral sand). One specimen (Cat. No. 5944, U.S.N.M.).

No. 55. Jolo, Jolo Island, Feb. 11, 1908. One specimen (Cat. No. 5942, U.S.N.M.).

No. 64. Station D5174 (off Jolo Light, Mar. 5, 1908, 20 fathoms, coarse sand). One specimen (Cat. No. 5949, U.S.N.M.).

No. 114. Station D5555 (off Cabalian Point, Jolo, Sept. 18, 1909, 34 fathoms, coarse sand). Two large specimens (Cat. No. 6025, U.S.N.M.)

No. 82. Station D5147 (off Sulade Island, Sulu Archipelago, Feb. 16, 1908, 21 fathoms, coral sand and shells). One specimen (Cat. No. 5946, U.S.N.M.).

No. 90. Station D5163 (off Observation Island, Sulu Archipelago, Feb. 24, 1908, 28 fathoms). One specimen (Cat. No. 5948, U.S.N.M.).

PHALLUSIA APERTA (Sluiter), 1904.

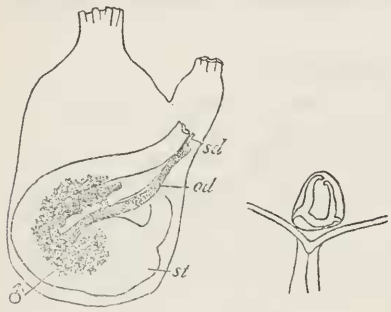
1904. *Ascidia aperta* Sluiter, *Siboga*-Exped., vol. 56*a*, p. 38, pl. 2, fig. 4; pl. 6, figs. 1–5.

1909. *Phallusia aperta* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1401.

In the only specimen in the collection the body is short, broad dorsoventrally, and decidedly compressed from side to side. Posterior border rounded, anterior portion of body somewhat produced,

bearing the branchial aperture at the end. Atrial aperture but slightly prominent, situated some distance back on the dorsal border. Attachment by a large part of the left side. Test yellowish, very smooth and shiny externally (much more so than in *Phallusia depressiuscula*, just described), and of a glassy transparency and fairly firm consistency. Apertures lobed, but in their contracted state the lobes can not readily be counted. Length, 38 mm.; dorsoventral diameter, 25 mm.; thickness from side to side, about 10 mm.

Mantle thin and transparent, its musculature slight, comprising slender radiating and circular bands on and near the tubes, and scattered transverse bands on the right side in the ventral region, but over most parts of the body no bands are noticeable. After removal from the test a few minute bright red ocelli are visible around the margin of the apertures. Eleven were counted about the branchial aperture; the number about the atrial aperture was not determined.



75 76

FIGS. 75, 76.—PHALLUSIA APERTA (SLUITER). 75, LEFT SIDE OF BODY. × 1.25. 76, DORSAL TUBERCLE. × 7.

Tentacles of three sizes arranged with some approach to regularity; a few additional fourth-order tentacles are also present, and the total number can hardly be less than 50.

Dorsal tubercle with an orifice of irregular horseshoe form; its open interval directed forward.

Dorsal lamina nearly or quite plain-edged in the anterior part; but in the posterior part cleft into numerous long narrow teeth, some of them dividing into two or three slender points.

Branchial sac in structure and appearance much like that of *Phallusia depressiuscula* just described. (See fig. 74.) Transverse vessels of two (in some parts three) orders fairly regularly arranged, with occasional much larger vessels at intervals which are not always in accord with the usual scheme of arrangement. Minute plications of the sac well developed; they are less numerous than (in some places only half as numerous as) the internal longitudinal vessels. Internal longitudinal vessels well developed and complete, though slender. They are separated by a varying number of stigmata (usually from 9 to 13), the number being influenced by the development and position of the minute plications already mentioned. At the crossing of the transverse and internal longitudinal vessels, but not at intermediate points, the latter vessels bear rather small curved papillae. These are provided with a membrane along their concave

side and usually have one or two small blunt projections at their base.

Alimentary loop of very simple form. Stomach comparatively small and short, extending nearly dorsoventrally across the posterior left side of the body. From the pyloric end of the stomach the intestine curves forward and extends obliquely dorsally, ending near the base of the atrial tube. Anus not distinctly lobed.

Ovary an irregular, elongated, sinuously convoluted body with a few small lateral branches extending along the inner border of the intestinal loop, its closed end situated where the ascending part of the intestine crosses the middle of the body, the other end near where the intestine leaves the stomach. At this point the ovary opens into the large oviduct, which at first runs along the anterior border of the stomach, and then leaves it and runs directly toward the terminal part of the intestine, which it accompanies nearly to the end of the rectum. The small irregularly lobed testes are not very numerous compared with their numbers in most other species of the genus. They are irregularly distributed over those parts of the intestine and stomach which are adjacent to the ovary and oviduct. The common sperm duct apparently accompanies the oviduct.

The only specimen (No. 15) (Cat. No. 6022, U.S.N.M.), of this well-marked species, readily distinguishable by the simple open loop formed by the alimentary tract, is from station D5147 (off Sulade Island, Sulu Archipelago, Feb. 16, 1908, 21 fathoms, coral sand and shells). Sluiter's (1904) specimens were from latitude 5° 36′ 30″ S.; longitude 132° 55′ 12″ E., 90 meters, and latitude 8° 19′ S.; longitude 117° 41′ E., 274 meters.

Family PEROPHORIDAE Giard, 1872.

Genus PEROPHORA Wiegmann, 1835.

PEROPHORA HUTCHISONI MacDonald, 1859.

1859. *Perophora hutchisoni* MacDonald, Trans, Linn. Soc. London, vol. 22, p. 377, pl. 65, div. II, figs. 1–3.

1891. *Perophora hutchinsoni* Herdman, Journ. Linn. Soc. London, vol. 23, p. 602.

1893–1909. *Perophora hutchisoni* Seeliger, Bronn's Tier-reich, vol. 3, suppl., pl. 37, fig. 9.

1898. *Perophora hutchisoni* Herdman, Ann. Mag. Nat. Hist., ser 7, vol. 1, p. 446.

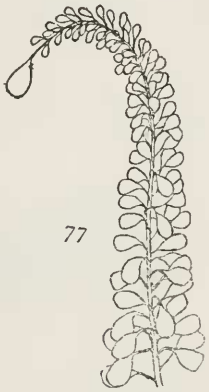
1899. *Perophora hutchisoni* Herdman, Cat. Australian Museum, Sydney, pp. 8 and 112.

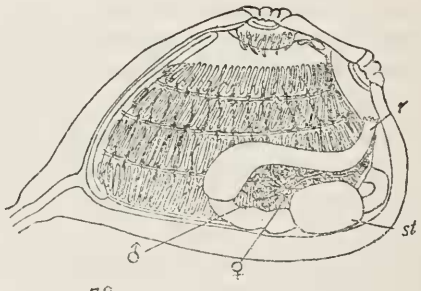
1909. *Perophora hutchisoni* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1487 (*P. hutchinsoni*, p. 1410.)

The only specimen, evidently but a part of a colony, consists of a slender stolon, about 50 mm. long, bearing nearly 100 zooids, each on

a separate lateral branch of the stolon. These lateral branches, the individual pedicels of the zooids, arise at rather close but not very regular intervals all around the stolon and are somewhat less in length than the body of the zooid they bear. The largest zooid (about 4 mm. in greatest diameter) is borne on the extreme tip of the stolon, but, with this exception, the zooids become regularly larger and more mature as the base of the stolon is approached.

Zooids somewhat egg-shaped, slightly compressed laterally, the pedicel arising from the small end, which is the posterior ventral part of the body. Apertures but slightly prominent, the branchial near the dorsal side of the large end of the body; the atrial nearly opposite the origin of the pedicel. Both are lobed, but the lobes are not readily counted in the contracted preserved specimen. Nine





FIGS. 77, 78.—PEROPHORA HUTCHISONI MACDONALD. 77, PART OF A COLONY. × 1.25. 78, ZOOID. × 13.

branchial and seven atrial lobes were demonstrated in one individual. Stolon, pedicels, and zooids are insheathed in a layer of clear colorless test substance, which becomes thicker on that part of the body of the zooid where the pedicel arises so that the outline of the zooid tapers off into that of the pedicel. Yellowish brown corpuscles occur in branching vessels in the mantel, digestive organs, and to some extent in other parts of the body.

Mantle musculature slight, composed of delicate, widely spaced bands. Some of these surround the apertures, others extend posteriorly on the sides from about the branchial aperture, or obliquely backward from the region of the endostyle.

Tentacles about 30 in number. Three orders can be recognized, but there is often considerable inequality in their arrangement, especially as far as the smaller tentacles are concerned. These are inserted a little nearer the aperture than the large ones.

Dorsal languets small, inserted on the median dorsal vessel.

Owing to the peculiar form of the body the anterior part of the branchial sac is much narrower than the posterior part. Four rows of long narrow stigmata are present; about 35 stigmata on each side in the anterior row, the number increasing gradually to nearly 50 in the posterior row. The three transverse vessels on each side; each bear about 15 or 16 papillae distributed fairly evenly along their length. These support slender longitudinal vessels, which (except those borne on papillae near the endostyle and median dorsal vessel) are mostly complete between the first and third transverse vessels but elsewhere are represented only by anteriorly or posteriorly extending branches of the papillae. Because of the increase in the number of stigmata in the posterior rows the internal longitudinal vessels are separated by only about two stigmata in the anterior part and by three or more in the posterior part of the sac.

Intestinal loop rather long dorso-ventrally and narrow in an antero-posterior direction. It is situated in the left posterior dorsal part of the body. The esophagus, which is much curved, begins at the posterior dorsal part of the sac; the stomach is small, oval, and smooth-walled; the intestine has a very marked valvelike constriction some distance beyond the stomach and is of larger diameter beyond the valve, tapering gradually from this point to the anus, which has a lobed margin.

Reproductive organs small and poorly developed in most of the individuals. In some a small number of pear-shaped testes entirely distinct from each other and each borne on a slender duct can readily be distinguished. They lie in the intestinal loop. Their ducts converge in a radial manner to form a stout common sperm duct which accompanies the terminal part of the intestine. In some zooids the ovary is visible as a group of small eggs lying beside the commencement of the common sperm duct.

The only specimen (No. 43) (Cat. No. 5926, U.S.N.M.) is from station D5597 (near Zamboanga Light, Mindadao, Oct. 12, 1909, 9 fathoms). MacDonald's type was from Australia.

Family CIONIDAE Lahille, 1887.

As restricted by Hartmeyer, this family has consisted only of the well-known and nearly cosmopolitan genus *Ciona*, which, though found in the Malay Archipelago, has not yet been collected in the Philippines. The family is separated from the Phallusiidae chiefly by having the continuous dorsal lamina replaced by separate languets, but is also characterized by its elongate body, and the powerful longitudinal muscle bands in the mantle, and by the position and course of the intestine, which lies partly behind and partly beside the branchial sac.

The *Albatross* collection contains, however, a new genus, which is in many respects intermediate between *Ciona* and *Phallusia*, to which the writer has given the name *Ciallusia*, a compound of parts of these two well-known generic names. If the families Cionidae and Phallusiidae require to be kept separate, which the new genus seems to render somewhat doubtful, *Ciallusia* appears to belong in the Cionidae on account of having the dorsal lamina replaced by languets.

CIALLUSIA, new genus.

Body elongated, tapering (pediceled in the only species); both apertures near together at the anterior end, the atrial aperture distinctly 6-lobed. Test gelatinous, transparent.

Mantle with a few transverse but no strong longitudinal muscle bands.

Tentacles simple.

Median dorsal vessel broad and flat; the dorsal lamina represented by separate languets. Internal longitudinal vessels are present, but bear no papillae.

Course of digestive tract very straight, only the esophagus and part in the vicinity of the stomach being curved, the remaining portion running directly forward. It lies beside the branchial sac.

Ovary beside the proximal part of the intestine. Male organs ramifying upon the surface of the stomach and intestine.

Type of the genus.—Ciallusia longa, new species.

CIALLUSIA LONGA, new species.

Body greatly elongated, laterally flattened, largest at the posterior end and tapering gradually toward the anterior end. Branchial aperture terminal, indistinctly lobed; atrial aperture smaller, 6-lobed, situated on a very short tube close beside the branchial aperture but not extending forward so far. Body attached by the posterior end by means of a long pedicel. (The pedicel is complete only in one of the specimens. In this it is between two-thirds and three-fourths of the length of the body proper, narrow where it joins the body but wide at the other end where it gives off a number of rootlike branches which anchored the animal in the sand or gravel in which it grew. In the other specimens the pedicel appears to have been similar, but it is broken off.) Dimensions of largest specimen: body length (including pedicel) 93 mm.; greatest dorso-ventral diameter (near posterior end of body proper), 24 mm.; length of pedicel about 67 mm.; greatest diameter of pedicel (at end farther from body), 17 mm.; smallest diameter of pedicel (near point of origin from body), 4 to 5 mm. Test transparent and nearly colorless

in the alcoholic specimens, moderately tough, with a smooth clean surface. Pedicel of substance similar to the test covering the body proper.

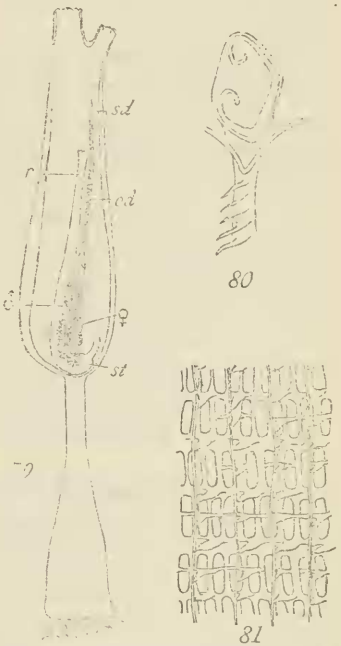
Mantle musculature slight, the sphincters of the apertures weak, being composed of narrow bands. The most conspicuous body muscles are short widely spaced transverse bands crossing the mid-dorsal and mid-ventral regions (about 20 to 30 on each region) but ending abruptly without extending far onto the sides of the body. In this respect it differs greatly from the genus *Ciona*, which has strong longitudinal body muscles arranged in wide bands.

Tentacles of several sizes, not very regularly arranged. A total of about 40 were counted in one of the smaller specimens.

Dorsal tubercle large but not prominent, its orifice irregularly C-shaped with the open interval to the right or somewhat forward. In the largest specimen the horns are somewhat inrolled.

Median dorsal vessel broad and flat, the dorsal lamina represented by a series of narrow, sharp-pointed languets inserted with the broad diameter of the base transverse to the median dorsal vessel.

In some parts of the sac three or four orders of transverse vessels quite regularly arranged can be recognized; in other parts the regularity is less. The smallest of the vessels usually cross without interrupting the stigmata and are interrupted and incomplete at many points. Well-developed though very slender internal longitudinal vessels are present and are separated by the width of only two or three stigmata. The latter are of rather short, broad oblong form in most parts of the sac, and are separated by rather wide interstigmatic vessels. The internal longitudinal vessels are borne on the ends of tapering supporting papillæ which rise from the transverse vessels (even from the small incomplete ones, those parts of the vessel which give rise to supporting papillæ being usually well developed even when intermediate parts are atrophied). No papillæ are borne on the internal longitudinal vessels.



FIGS. 79–81.—CIALLUSIA LONGA, NEW SPECIES. 79, LEFT SIDE OF BODY. ONE-HALF NATURAL SIZE. 80, DORSAL TUBERCLE AND PART OF DORSAL LAMINA. × 9. 81, PART OF BRANCHIAL SAC. × 21.

Esophagus short and curved, stomach small and inconspicuous, of short oval form, and situated beside, or extending a trifle posterior to, the posterior end of the branchial sac. From the stomach the intestine bends forward and extends straight forward toward the anterior end of the body, ending at about one-third the body length from the anterior end in an orifice whose border has many small lobes.

Ovary elongate, tapering gradually into the stout oviduct. Ovary and oviduct lie along the dorsal side of the intestine, the oviduct extending farther toward the anterior end of the body than the intestine.

The male organs consist of many small glands connected by branching ducts which ramify over the surface of the stomach and posterior part of the intestine. They discharge by a common duct which lies along the ovary and oviduct (for the most part upon that side of the latter which is toward the branchial sac) and which extends still nearer the anterior end of the body than the oviduct.

Represented in the collection by three specimens, all rather large, from two localities, which are as follows:

No. 103. Station D5432 (off Corandagos Island, Apr. 8, 1909, 51 fathoms, sand). One specimen. (Cat. No. 5980, U.S.N.M.)

No. 152. Station D5153 (off Tocanhi Point, Sulu Archipelago, Feb. 19, 1908, 49 fathoms, coral sand and shells). Two specimens. (Large one is type, Cat. No. 6039, U.S.N.M.)

Family DIAZONIDAE Garstang, 1891.

Genus RHOPALOPSIS Herdman, 1890.

RHOPALOPSIS CRASSA (Herdman), 1880.

Plate 28, fig. 14.

1880. *Ecteinascidia crassa* Herdman, Proc. Roy. Soc. Edinburgh, vol. 10, p. 723.

1882. *Ectcinascidia crassa* Herdman, Rep. Voy. *Challenger*, vol. 6, Tunicata, p. 241, pl. 36, figs. 12–14.

1890. *Rhopalopsis crassa* Herdman, Proc. Liverpool Biol. Soc., vol. 5, p. 160.

1891. *Rhopalopsis crassa* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 601.

1898. *Rhopalopsis crassa* Herdman, Ann. Mag. Nat. Hist., ser. 7, vol. 1, p. 447.

1899. *Rhopalopsis crassa* Herdman, Cat. Australian Mus. Sydney, No. 17, pp. 8 and 112.

1904. *Rhopalopsis crassa* Sluiter, *Siboga*-Expedition, vol. 56*a*, p. 126.

1909. *Rhopalopsis crassa* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1418.

As explained below, the writer feels little doubt that *Rhopalopsis fusca* Herdman (1880) is identical with the above species. As it was

described on the same page of Herdman's article as *R. crassa*, but following the latter, the name *crassa* has priority if the identity of the two forms is admitted. The references to *R. fusca* are as follows:

1880. *Ectcinascidia fusca* Herdman, Proc. Roy. Soc. Edinburgh, vol. 10, p. 723.
1882. *Ectcinascidia fusca* Herdman, Rep. Voy. *Challenger*, vol. 6, Tunicata, p. 241, pl. 36, figs. 7–11.
1890. *Rhopalopsis fusca* Herdman, Proc. Liverpool Biol. Soc., vol. 5, p. 160.
1891. *Rhopalopsis fusca* Herdman, Journ. Linn. Soc. London Zool., vol. 23, p. 601.
1893–1907. *Rhopalopsis fusca* Seeliger, Bronn's Tier-reich, vol. 3, suppl., pl. 37, fig. 8.
1898. *Rhopalopsis fusca* Herdman, Ann. Mag. Nat. Hist., ser. 7, vol. 1, p. 447.
1899. *Rhopalopsis fusca* Herdman, Cat. Australian Mus., Sydney, No. 17, pp. 8 and 112.
1904. *Rhopalopsis fusca* Sluiter, *Siboga*-Exped., vol. 56*a*, p. 13, pl. 2, fig. 6.
1909. *Rhopalopsis fusca* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1418.
1912. *Rhopalopsis fusca* Hartmeyer, Deutsche Tiefsee-Exped., vol. 16, p. 373.

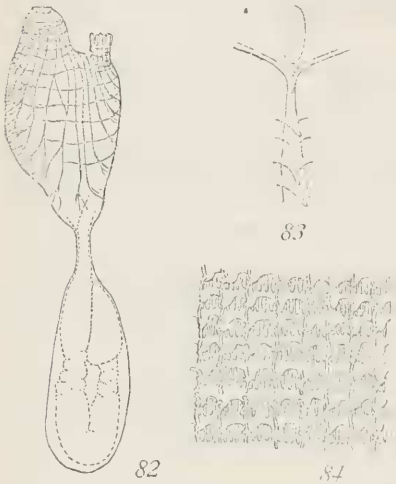
All the specimens except one consist of a single isolated zooid, giving no indication of forming buds or of having developed by budding. The remaining specimen (pl. 28, fig. 14), consists of 3 zooids of different sizes growing with their basal (posterior) ends near together and united by a continuous connection of test substance, although the writer did not succeed in demonstrating a stolon connecting the zooids.

Whether growing singly or united, each zooid is inclosed in its own covering of test, which is of a yellowish or brownish yellow color (greenish yellow in a formaldehyde specimen) and of a tough, somewhat cartilagenous consistency, only slightly transparent or merely translucent. The test is very thick, the cavity occupied by the zooid's body often appearing very small in comparison; the inner layer immediately ensheathing the abdomen of the zooid is much tougher and more rigid than elsewhere. Ordinarily the animal is attached by the posterior end or more or less obliquely by that end and a part of one side, sometimes by a large part of one side. The test being of very irregular thickness, the external form is very variable, but in the more regular specimens it is somewhat club-shaped, the anterior end being often much swollen into a large rounded knob-like head. The apertures are not prominent externally. Length of the largest specimen 45 mm., maximum width about 19 mm., but some smaller ones are proportionally wider.

When removed from the test the zooid has the typical form of a compound ascidian, consisting of a thorax connected by a narrow constricted region or neck with an abdomen of the usual oval form containing the stomach, intestinal loop, and reproductive glands.

Owing to the contractions incident to preservation the neck or constricted part of the body was found broken in nearly every specimen. Length of the largest zooids when removed from the test in their partly contracted condition 30 to 35 mm. The thorax when expanded forms considerably over half the length, but in the contracted state only about one-half or less. Branchial aperture plain or only obscurely lobed; atrial aperture prominent, anteriorly directed and provided with 6 distinct lobes.

Mantle thin, provided with a very variable number of conspicuous muscle bands which on the sides of the thorax are rather irregularly distributed and longitudinal in direction, but curve and assume a transverse direction at their posterior ends, so that they approach either the endostyle or the median dorsal line. At the same time they divide or spread out into a number of narrow bands.



FIGS. 82–84.—RHOPALOPSIS CRASSA (HERDMAN). 82, OUTLINE OF ZOOID (REMOVED FROM TEST) SHOWING COURSE OF MUSCLE BANDS ON MANTLE AND OUTLINE OF INTESTINAL LOOP. × 2. 83, DORSAL TUBERCLE AND PART OF DORSAL LAMINA. × 20. 84, PART OF BRANCHIAL SAC. × 20.

Other transverse muscles (except about the apertures) are few and weak. No conspicuous muscle bands on the abdomen.

In one specimen seven large tentacles were counted, additional smaller ones of at least two orders are somewhat irregularly distributed in the intervals. Small papilla-like prominences farther forward within the branchial tube may represent rudimentary tentacles of higher orders.

Dorsal tubercle large, elongate oval, with an elongate oval orifice.

Dorsal lamina represented by a series of triangular languets expanded in a direction transverse to the median dorsal vessel from which they arise.

Branchial sac with numerous (sometimes 100) transverse vessels which are of nearly uniform size and bear attached along their length a membrane raised into triangular supporting papillæ that carry slender internal longitudinal vessels. These are attached almost but not quite at the tips of the supporting papillae (that is, the latter project a very little above the internal longitudinal vessels). In some places the latter vessels are incomplete and interrupted, so that they appear only as short lateral branches of the supporting papillae,

but over considerable areas of the sac the internal longitudinal vessels are perfect, at least in most specimens. These vessels are separated by from three to four stigmata, and number 40 to 50 on each side of the body in fair-sized specimens.

Stomach oval, perhaps with longitudinally corrugated walls, but this is uncertain. Intestine of large diameter and forming a long loop.

Reproductive organs situated beside the intestinal loop. Ovary large, sac-like, containing a vast number of small eggs. Testes very numerous. They are minute pear-shaped glands discharging by a stout sinuous common sperm duct which accompanies the ascending branch of the intestine.

The above-mentioned group or colony of individuals (No. 38) is from station D5168 (off Observation Island, Tawi Tawi Group, Sulu Archipelago, Feb. 25, 1908, 80 fathoms, coral sand).

The single zooids are from:

No. 93. Station L5108 (off Corregidor Light, Jan. 15, 1908, 13 fathoms, coral) (Cat. No. 5936, U.S.N.M.).

No. 83. Station D5141 (off Jolo Light, Feb. 15, 1908, 29 fathoms, coral sand) (Cat. No. 5937, U.S.N.M.).

No. 37. Station D5174 (off Jolo Light, Mar. 15, 1908, 20 fathoms, coarse sand) (Cat. No. 5940, U.S.N.M.).

No. 34. Station 5555 (off Cabalian Point, Jolo Island, Sept. 18, 1909, 34 fathoms, coarse sand) (Cat. No. 5941, U.S.N.M.).

No. 53. Station D5159 (off Tinakta Island, Feb. 21, 1908, 10 fathoms, coral sand). Two specimens (Cat. No. 5938, U.S.N.M.)

The Philippine specimens are clearly of the species which has commonly been known as *R. fusca* Herdman. It is common and widely distributed in the Malay region and occurs on various kinds of bottom and at various depths. The *Siboga* Expedition obtained it from coral reefs and at depths down to 521 meters. According to Sluiter (1904) its color when living is dark blue.

The great variability exhibited by the Philippine specimens and the apparent absence of any important structural differences between the species lead the writer to the conclusion that the two species *R. crassa* from the Ki Islands, 129 fathoms, and *R. fusca* from Banda, Moluccas, 17 fathoms, collected by the *Challenger* Expedition and described in Herdman's reports are identical, and that for the reason above noted the name *crassa* should replace *fusca*. Herdman (1906, p. 299, pl. 1, figs. 15–17) has described a species from Ceylon under the name *Ecteinascidia* (? *Rhopalopsis*) *solida*, which appears to be also so closely related to *R. crassa* that it may eventually require to be united with it.

Family CLAVELINIDAE Forbes, 1848.

[=CLAVELINIDAE+POLYCITORIDAE s. DISTOMIDAE Authors.]

The propriety of uniting these closely allied families has already been suggested by several writers, including Hartmeyer, though he failed to adopt the plan in his classification.

The group thus enlarged comprises compound ascidians forming colonies either of the social type with separate zooids connected by stolons, or having the zooids completely buried in a common mass of test and discharging into common cloacal cavities, or exhibiting any of various intermediate types. Zooids without any trace of internal longitudinal vessels.

Genus CLAVELINA Savigny, 1816.

[=*Clavelina* Savigny, 1816+*Podoclavella* Herdman, 1890+*Chondrostachys* MacDonald, 1858+*Rhodozona* Van Name, 1902.]

These genera are united on the ground that the characters distinguishing them are entirely superficial ones (chiefly the degree of separation of the zooids in the colony), which are variable not only in different colonies of one species but often in the same colony at different stages of growth.

CLAVELINA MOLLUCCENSIS (Sluiter), 1895.

1895. *Podoclavella meridionalis* Sluiter, Denschr. Med.-Nat. Ges. Jena, vol. 8, p. 165, pl. 6, figs. 1–4.

1899. *Podoclavella meridionalis* (part) Herdman, Cat. Australian Mus., Sydney, No. 17, pp. 5 and 112.

1904. *Podoclavella molluccensis* Sluiter, *Siboga*-Exped., vol. 56*a*, p. 5.

1908. *Podoclavella meridionalis* Pizon, Rev. Suisse Zoologique, vol. 16, p. 197, pl. 9, figs. 1–4.

1909. *Podoclavella molluccensis* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1426.

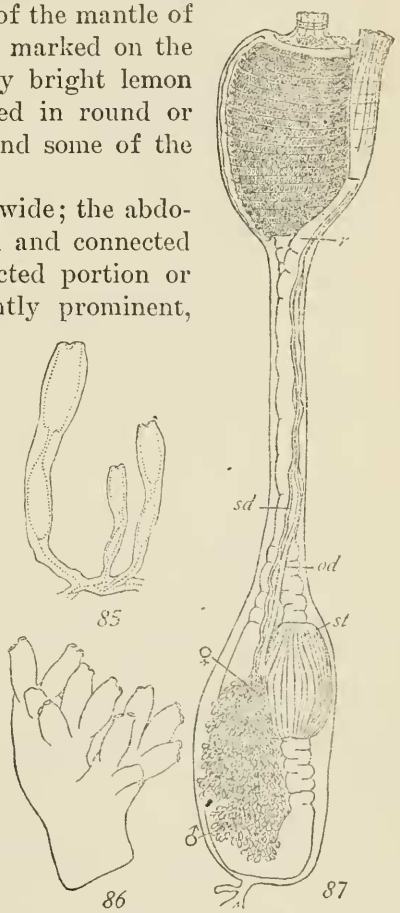
If the writer is correct in referring all the colonies listed below to this species, it is a very variable one, its characters being greatly influenced by the age or stage of development of the colony and perhaps also by the conditions under which it grows. Each zooid may have its own separate sheath of test inclosing the body for its entire length, or only the anterior parts of the zooids may be separately ensheathed, their posterior parts being embedded in a mass of test common to several or all of them. In the best-developed and most fully adult specimens in the collection, however, each zooid is inclosed in a separate club-shaped sheath of transparent pale yellowish gray or nearly colorless test, which becomes tough and horny on the basal part of the zooid, where it is extended into a pedicel, the several zooids constituting the specimen being connected only by a

basal stolon which is also sheathed in tough horny test. The largest zooid measures 70 mm. high and 10 mm. in greatest width, inclusive of its covering of test and pedicel, but only 45 mm. high when removed from the test in the preserved partially contracted condition. The other zooids of the specimen are considerably smaller though apparently equally mature. Color of the mantle of the zooids deep purple, irregularly marked on the anterior part with an area of very bright lemon yellow, these colors being contained in round or oval pigment cells in the mantle and some of the internal tissues.

Zooids having the thorax rather wide; the abdomen is narrow and more elongated and connected with the thorax by a long contracted portion or neck. Apertures often only slightly prominent, near together; the branchial terminal, 6-lobed; the atrial on a very short forwardly or somewhat dorsally directed tube, also more or less distinctly lobed, at least in some individuals. A stout vascular process at the posterior end of the abdomen extends down through the pedicel and connects the zooid with the common stolon.

Musculature of mantle well developed, comprising a very variable number of fairly stout, chiefly longitudinal bands underlaid by slender closely placed transverse muscles on the thorax, but on the posterior parts of the body only longitudinal muscles of a more diffuse character are visible.

Tentacles numerous, of several sizes, the small ones inserted nearer the branchial aperture than the larger ones.



FIGS. 85–87.—CLAVELINA MOLLUCCENSIS (SLUITER). 85, DIAGRAM OF PART OF A COLONY BASED ON SPECIMENS FROM STATION D5401. ONE-HALF NATURAL SIZE. 86, COLONY WITH BASAL PARTS OF ZOOIDS UNITED. × 1.25. 87, ZOOID. × 3.

Dorsal languets arising from the median dorsal vessel itself, though to the left of the middle line of the same. Their bases are continuous with membranes borne on the transverse vessels of the sac.

Stigmata in about 25 rows, with at least 40 in a row on each side (in large zooids probably considerably more). Transverse vessels provided with a rather broad membrane along the side toward the

interior of the branchial sac. These membranes became continuous with the bases of the dorsal languets at the median dorsal vessel.

Intestinal loop long; stomach oval. Generally it is smooth-walled, but numerous narrow longitudinal streaks of dark pigment, which the writer believes indicate slight plications, can be made out in some zooids.

Reproductive organs beside the intestinal loop, their ducts accompanying the ascending part of the intestine. Ovary a small sac containing a large number of small eggs. Testes exceedingly numerous, small oval bodies covering up much of the ovary and adjacent portions of the intestinal loop. In some zooids small tailed larvae are present in the atrial cavity, which is more or less expanded to contain them.

Colonies not mature and those which appear to have grown under less favorable conditions differ from the above description in many respects. The zooids are always much smaller, not often over half or one-third the above size, and among the specimens in the collection none are so conspicuously pigmented as the large ones above described. Some show no pigment cells at all; the zooids have, however, more or less of a reddish or pale purplish gray tinge due to diffused color. The test has a similar but paler color and is semitransparent. The zooids are not so completely separate as in the colony above described, the anterior part of the zooid only has its own sheath of test, the posterior part being imbedded in a common mass of test. Several such common masses, each containing a group of zooids, may be united into a single colony, all arising as lobes or branches of a still larger trunk-like mass of test (fig. 86).

In very immature colonies, perhaps also in those that have passed through a stage of degeneration and shrinkage and are starting to grow again, the zooids, which are small and numerous and have the branchial sac and other internal organs as yet only imperfectly developed, are completely and often quite deeply buried in a common mass of test, as in ordinary compound ascidians, the colony having a short, thick cylindrical form, attached by one end, or in other cases dividing into several lobes or thick branches. The zooids are connected by branching vessels in the basal part of the colonies. Some of the specimens in this undeveloped condition are quite large (one from station D5164 is about 65 mm. high and nearly 20 mm. in transverse diameter), and would, if all the zooids which are developing in them should attain the full size, make very extensive colonies.

The specimens assigned to this species are all from shallow water (not over 30 fathoms), except one from station D5518, from a depth of 200 fathoms.

Specimens with adult or nearly adult zooids are from:

No. 146. Station D5401 (off Tanguingi Island, north of Cebu, Mar. 16, 1909, 30 fathoms, fine sand). A few large, completely separate, deeply pigmented zooids, probably all forming one colony as described above (Cat. No. 5967, U.S.N.M.).

No. 153. Station D5513 (off Point Tagolo Light, northern Mindanao, Aug. 7, 1909, 505 fathoms, gray mud and Globigerina). Small colony with only one large fully developed zooid and a few immature or degenerate ones. Not pigmented. (Cat. No. 5968, U.S.N.M.)

No. 42. Station D5145 (near Jolo Light, Feb. 15, 1908, 23 fathoms, coral sand and shells). Small colony, zooids stunted and imperfectly separated, somewhat pigmented (Cat. No. 5919, U.S.N.M.).

Immature or degenerate colonies, probably of this species, are from:

No. 47. Station D5144 (off Jolo Light, Feb. 15, 1908, 19 fathoms, coral sand). Small colony (Cat. No. 5918, U.S.N.M.).

No. 95. Station D5174 (off Jolo Light, Mar. 5, 1908, 20 fathoms, coarse sand). Small colony (Cat. No. 5917, U.S.N.M.).

No. 143. Station D5164 (off Observation Island, Tawi Tawi Group, Sulu Archipelago, Feb. 24, 1908, 18 fathoms, green mud). Several colonies, all containing only immature zooids deeply buried in the common test (Cat. No. 5970, U.S.N.M.).

Sluiter (1895) at first considered this species identical with Herdman's (1890, 1899) *Podoclavella meridionalis* from Port Jackson, Australia. Afterwards (1904) he concluded it was distinct and gave it the name *molluccensis*, which is here adopted, though from the great variability of the specimens in the *Albatross* collection, the writer is inclined to question the importance and constancy of the characters separating Sluiter's species from Herdman's.

This ascidian is widely distributed in the Malay Archipelago (see Sluiter, 1904), ranging, according to that author, from shallow water to 113 meters. Pizon's (1908) *Podoclavella meridionalis* from Amboina is undoubtedly this species.

CLAVELINA DETORTA (Sluiter), 1904.

Plate 31, fig. 29.

1904. *Podoclavella detorta* Sluiter, *Siboga*-Exped., vol. 56*a*, p. 6, pl. 3, figs. 18–22.

1909. *Podoclavella detorta* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1426.

The larger of the two specimens consists of a dense group of 40 or 50 zooids arising from a common base composed of a compacted mass of branching stolons, each zooid being inclosed in an entirely separate covering of test substance and capable of being easily separated from its neighbors without injury, though in the natural condition of the colony it is in close contact with them and is connected with

them through vascular processes arising from the posterior end of the abdomen and joining the common stolons. The smaller specimen is a looser group of a few zooids connected by stolons.

The largest zooids are in the preserved condition about 23 mm. long. Each consists of a long, very narrow abdomen inclosed in a tubular sheath of tough test which extends posteriorly into a more or less elongate pedicel and at the anterior end enlarges (expanding more toward the ventral than toward the dorsal side) into a rounded or oval mass inclosing the thorax. The thorax is short, wide in a dorso-ventral direction, and narrow from side to side. Branchial aperture slightly lobed or almost plain, atrial aperture larger, and plain edged. Neither is greatly produced. The abdomen joins the thorax at the extreme posterior dorsal part of the latter, and an abrupt bend in the proximal part of the abdomen is generally present, so that the main axis of the thorax assumes a direction nearly at right angles to the long axis of the abdomen and pedicel.

FIG. 88.—CLAVELINA DETORTA (SLUITER). LEFT SIDE OF BODY OF ZOOID. × 4.

Mantle thin; about the apertures there are slender circular fibers, but no strong sphincters. On each side of the thorax about 15 narrow widely separated muscle bands extend posteriorly from the region about and between the apertures, each being generally formed by the union of two or more slender bands. Transverse muscles are but little developed, though a few slender circular bands cross the longitudinal ones on the anterior part of the thorax.

Tentacles 16; 8 large and 8 smaller ones alternating.

Dorsal tubercle prominent; cup-shaped with a rounded orifice.

Dorsal lamina replaced by a series of large triangular languets borne transversely upon the wide median dorsal vessel. They are continuous at their lateral angles with broad membranes borne along the whole length of the transverse vessels of the sac.

Stigmata long and narrow, separated by very slender interstigmatic vessels. Number of rows apparently 6, with about 40 in a row on each side.

Intestinal loop very long. Stomach long and narrow, not noticeably wider than some parts of the intestine. Apparently it is smooth walled.

Some individuals contained embryos or tailed larvae in the dorsal part of the thorax or proximal part of the abdomen. The reproductive organs lie beside the intestinal loop in the posterior part of the abdomen. The testes are rather few in number and form a rounded group from the middle of which the common sperm duct has its origin. The ovary is small and sac-like and lies chiefly anterior to the group of testes. It contained but few eggs in the specimens studied.

The large colony (No. 142) (Cat No. 5969, U.S.N.M.), above described is from station D5139 (off Jolo Light, Feb. 14, 1908, 20 fathoms, coral sand). The smaller one (No. 12) (Cat. No. 5885, U.S.N.M.), from station D5145 (near Jolo Light, Feb. 15, 1908, 23 fathoms, coral sand and shells).

Sluiter (1904) described this species from two specimens dredged in lat. 70° 55.5′ S.; long. 114° 26′ E., 15 fathoms, coral and stones.

Genus POLYCITOR Renier, 1804.

[=*Distoma* Authors.]

The Philippine species belong to the subgenus *Eudistoma* Caullery, 1909.

POLYCITOR IANTHINUS Sluiter, 1909.

Plate 31, fig. 28.

1909. *Polycitor ianthinus* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 20. pl. 2, fig. 2; pl. 8, fig. 3.

1909. *Eudistoma ianthinum* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1488.

Colony a thick flattened mass rounded at the edges, and if any general statement can be based on the few specimens in the collection, usually of oval or elongate outline, one end broader than the other, the attachment being by the narrower end. One specimen much narrower than the others may well be described as club shaped, though it is also somewhat flattened in one direction. Test rather opaque, grayish brown and moderately tough. It contains numerous large oval cells containing brown pigment; these cells are abundant in the deeper portions of the test as well as in the superficial layers and are a very conspicuous feature, giving the colony as a whole, a very dark-brown color. Tissues of the zooids also brown. Surface of colony rather uneven, small pits or depressions indicating the positions of the zooids. Largest colony 65 mm. long, 42 mm. in greatest width, and about 15 mm. thick.

Zooids rather large, often 5 mm. long even when somewhat contracted. Thorax rather small, oblong, the 6-lobed branchial aperture on a very short tube at the anterior end; the atrial aperture also 6-lobed but smaller, situated on a tapering tube nearly or quite as long

as the thorax, which arises from the posterior part of the dorsal side of the thorax, and in most zooids is directed forward (fig. 89), but it occasionally extends out at right angles to the length of the body. A long narrow neck which often becomes much bent and contracted in preservation connects the thorax and the abdomen. Vascular processes of the abdomen were not noted.

Mantle musculature consisting of a superficial layer of narrow, rather widely spaced bands underlaid by slender groups of transverse fibers so closely placed as to form a nearly continuous sheet, which also covers the atrial and branchial tubes. Posterior to the thorax the transverse muscles practically disappear, though the longitudinal muscles are conspicuous even on the abdomen; the bands, however, spread out and unite with each other to form a practically continuous sheet.

FIG. 89.—POLYCITOR IANTHINUS SLUITER. ZOOID. × 18.

Tentacles apparently few; only two sizes were certainly demonstrated.

Dorsal languets small, arising from the transverse vessels of the left side the width of about four stigmata from the median dorsal vessel.

Branchial sac with only three rows of rather long narrow stigmata, with at least 18 or 20 stigmata in a row on each side. Near each end of each row the last few stigmata become successively shorter.

Stomach short and rounded, smooth-walled; margin of anus somewhat two lipped.

The reproductive organs lie beside the intestinal loop and are of the type usual in this family. The male glands numbered 15 to 20 in zooids of the specimen from Bantayan mentioned below. Reproductive organs not developed in the *Albatross* specimens.

The only colonies containing well-developed zooids are two (No. 126) (Cat. No. 6029, U.S.N.M.), from station D5139 (off Jolo Light, Feb. 14, 1908, 20 fathoms, coral sand).

Large colonies, containing very few zooids, except some in a degenerate condition, were obtained (No. 111) (Cat. No. 6030, U.S.N.M.), at station D5145 (near Jolo Light, Feb. 15, 1908, 23 fathoms, coral sand and shells) and (No. 119) (Cat. No. 6028, U.S.N.M.), at station D5160 (off Tinakta Island, Sulu Archipelago, Feb. 22, 1908, 12 fathoms, sand). One colony at each place.

The United States National Museum has also a colony received from the University of the Philippines collected at Bantayan by Dr. L. E. Griffin and Mr. L. D. Wharton.

Sluiter (1909) describes the species to which these specimens appear to belong from reefs at Nusa Laut and Banda. He describes his specimens as a dark brownish violet, a variation in color from the Philippine specimens, though not too great to render the identification improbable.

POLYCITOR TOROSUS Sluiter, 1909.

Plate 32, fig. 41.

1909. *Polycitor torosus* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 18, pl. 1, fig. 19; pl. 6, fig. 3.

1909. *Eudistoma torosum* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1488.

The few specimens in the collection indicate a tendency of the colony to assume a capitate form, the upper surface being somewhat flattened and the sides nearly vertical, though converging a little toward the base, which is not very much less in diameter than the upper part. The largest specimen is evidently not an entire colony; its greatest diameter is about 38 mm.; its height appears to have been less than this.

Test gelatinous, yellowish with a tinge of olive, semitransparent with a smooth shining surface on the upper part of the colony, though this may be slightly depressed and darker colored over the position of each zooid. The lower part of the sides of the colony may be somewhat wrinkled transversely, and discolored or roughened with some adherent mud or sand.

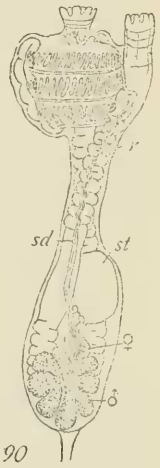


Fig. 90. — Polycitor torosus Sluiter. Zooid. × 25.

Zooids rather small, often only 2 mm. or less in length in the violently contracted and distorted state in which they occur in preservation, the long constricted pedicel or neck connecting the thorax and abdomen being so shortened that the abdomen comes against the thorax. When even moderately extended they are, however, two or three times the above length.

Branchial and atrial apertures on fairly prominent forwardly directed tubes, both 6-lobed. One or more vascular processes arise from the posterior end of the body.

Mantle with numerous strong longitudinal bands on the thorax. These muscles continue back on the abdomen, but become more diffuse and less conspicuous.

Tentacles not very numerous, apparently of three sizes, the smallest inserted somewhat nearer the aperture than the rest.

Dorsal languets not demonstrated.

Stigmata apparently in three rows (possibly four); probably 18 or 20 in a row on each side.

Stomach rounded, smooth-walled. Intestinal loop twisted so as to bring the stomach to the posterior side.

Many of the zooids contain large embryos in the ventral region of the thorax and anterior part of the abdomen and large eggs farther back in the ventral region. The ovary itself, containing a small group of eggs of different sizes, is situated beside the intestinal loop, where the testes are also situated; the latter are few in number, pear-shaped, and placed radially in a group. The sperm duct arises from the center of the group of testes and passes to the intestine, extending along it into the thorax. An oviduct was not demonstrated.

Localities for this species:

No. 63. Station D5163 (off Observation Island, Tawi Tawi Group, Sulu Archipelago, Feb. 24, 1908, 28 fathoms, coral sand). One colony.

No. 62. Station D5168 (off Observation Island, Feb. 25, 1908, 80 fathoms, coral sand). Several colonies (Cat. No. 5960, U.S.N.M.).

Sluiter (1909) described the species from a reef at Haingsisi.

Genus CYSTODITES von Drasche, 1883.

CYSTODITES PHILIPPINENSIS Herdman, 1886.

Plate 28, fig. 15.

1886. *Cystodytes philippinensis* Herdman, Rep. Voy. *Challenger*, vol. 14, Tunicata, p. 140, pl. 20, figs. 1 and 2.

1891. *Cystodytes philippinensis* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 615.

1893–1907. *Cystodites philippinensis* Seeliger, Bronn's Tier-reich, vol. 3, suppl., pl. 14, fig. 14.

1906. *Cystodites philippinensis* Herdman, Rep. Ceylon Pearl Oyster Fisheries, pt. 5, p. 334.

1909. *Cystodites philippinensis* Sluiter, *Siboga*-Exped., vol. 56*b*, pp. 28, 30. 28. 30.

1909. *Cystodites philippinensis* Caullery, Bull. Sci. France Belgique, vol. 42, p. 45.

1909. *Cystodites philippinensis* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1434.

Colony flat and rather thin, generally quite uniform in thickness, with the zooids evenly but not very thickly distributed, each zooid when contracted being surrounded by a calcareous capsule. This capsule is very dense and firm and is formed of overlapping shield-shaped calcareous spicules which mostly measure from 0.20 to 0.38 mm. in diameter. These capsules show more or less plainly through the semitransparent test; the latter is of a light brown color, due in part to diffused color and in part to brown pigment cells distributed chiefly in the upper layers. There are also deposits of ir-

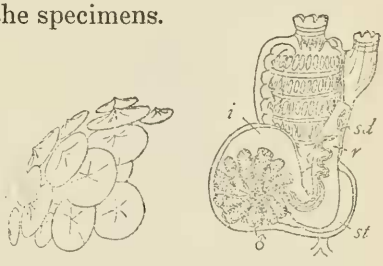
regular grains of calcareous matter, broken spicules, etc., among the spicules of the capsules and in the basal parts of most of the colonies. Size of largest colony 70 by 38 mm. across and about 4 mm. thick.

The constricted part of the body connecting the thorax and abdomen of the zooid is very short, and when contracted the thorax is drawn down so that it lies partly beside the abdomen and is received within the calcareous capsule; the entire zooid then does not occupy a length of much over 1 mm. There are strong longitudinal muscles in the mantle to bring about this contraction; on the sides of the thorax they form a number of separate bands, but at the posterior end of the thorax they converge to a single broad band on each side and this spreads out again to a thin sheet on the side of the abdomen. Apertures on tubes (that for the atrial aperture the longer), both with six lobes.

Tentacles rather numerous, apparently of three orders. Their arrangement is difficult to determine in the specimens.

Dorsal languets not demonstrated.

Stigmata only moderately numerous. Four rows have been represented in figure 92 as the most probable number, but the contracted state of the sac prevented counting them.



91 92

FIGS. 91, 92.—CYSTODITES PHILIPPINENSIS HERDMAN. 91, SPICULES. × 20. 92, ZOOID. × 25.

There are about a dozen male glands; they are oblong or cuneate bodies placed radially in a circle, the common sperm duct proceeding from the center of the group. The ovaries were not made out in the specimens studied, but some of the zooids have large eggs or embryos beneath the mantle.

This appears to be a common and widely distributed species in shallow water, as it is represented by the following specimens.

No. 87. Station D5108 (off Corregidor Light, Jan. 15, 1908, 13 fathoms, coral). Several colonies (Cat. No. 5924, U.S.N.M.).

No. 40. Station D5141 (off Jolo Light, Feb. 15, 1908, 29 fathoms, coral and sand). Several small colonies (Cat. No. 5923, U.S.N.M.).

No. 33. Jolo, Jolo Island, February 11, 1908. One colony (Cat. No. 5922, U.S.N.M.).

No. 22. Station D5174 (off Jolo Light, Mar. 5, 1908, 20 fathoms coarse sand). One large colony (Cat. No. 5971, U.S.N.M.).

No. 106. Station D5149 (off Sirun Island, Sulu Archipelago, Feb. 18, 1908, 10 fathoms, coral and shells). Several colonies (Cat. No. 5972, U.S.N.M.).

This species was obtained by the *Challenger* expedition at Zamboanga, Philippines, in 10 fathoms. The genus *Cystodites* consists

of a number of very similar forms, many of which will probably eventually prove to be identical. *C. ceylonensis* Herdman (1906, p. 334, pl. 8, figs. 23–25) from Ceylon is one of those which appear to be very closely allied to the present form.

Genus HOLOZOA Lesson, 1830.

[=*Distaplia* Della Valle, 1881.]

HOLOZOA VALLII (Herdman), 1886.

Plate 33, figs. 47 and 48.

1886. *Distaplia vallii* Herdman, Rep. Voy. *Challenger*, vol. 14, Tunicata, p. 128, pl. 18, figs. 1–6.
1891. *Distaplia vallii* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 613.
1893–1907. *Distaplia vallei* Seeliger, Bronn's Tier-reich, vol. 3, suppl., pl. 38, fig. 4.
1909. *Distaplia vallii* Caullery, Bull. Sci. France Belgique, vol. 42, p. 45.
1909. *Holozoa vallei* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1437.
1912. *Holozoa vallii* Hartmeyer, Deutsche Südpolar-Expedition, vol. 12, Zool., pt. 4, p. 486.

The numerous specimens in the collection exhibit great variation in the form of the colony, ranging from distinctly capitate colonies, raised on a short but more or less distinct neck, to irregular rounded masses and even flattened incrusting forms. The most symmetrical and one of the largest colonies is nearly egg-shaped, though flattened in one direction, 55 mm. high by 37 mm. in greatest transverse diameter, and was attached by a very short thick neck arising at the large end. A majority of the specimens are, however, quite irregular in form, though a tendency to approach the capitate type prevails. Test, in the alcoholic specimens at least, of a rather soft, somewhat fibrous or sponge-like texture, very opaque, the surface generally not very smooth and often indicating by rough, slightly depressed areas the positions of the groups of zooids. In those cases where the limits of the systems appear to be distinguishable, the systems, though varying in form and extent and often irregular in outline, seem to be mostly rather small and simple. Color of the colonies very variable; the ground color is yellowish, greenish, or brownish, this being more or less extensively mottled or marbled in the superficial parts with areas of some other color; greenish yellow, dark green, dull purple or purplish red (the color varying in different colonies), these colored areas being due to collections of rounded or oval pigment cells, green cells predominating or occurring exclusively in some colonies, while in others red cells are present in sufficient number to give the red or purple coloration, though green ones are also present.

When exceptionally well preserved and considerably expanded, the zooids may be 4 to 5 mm. long, but in some specimens they are so contracted as to hardly average half the above length. Branchial apertures usually not conspicuously lobed. Atrial aperture very variable in size and form in different zooids; sometimes it is merely a large opening whose edges are neither lobed nor produced; in other cases it is smaller and situated at the end of a tubular siphon; in others again the anterior edge is produced into a languet of more or less conspicuous size and length (fig. 93).

Mantle musculature delicate, composed mainly of slender transverse and oblique bands, and circular bands surrounding the apertures.

Tentacles 8 in number; of two sizes, placed alternately.

Dorsal languets arising from the transverse vessels of the left side at some distance from the median dorsal vessel.

Stigmata in 4 rows, about 25 in a row on each side. A narrow intermediate transverse vessel crosses without interrupting the stigmata of each row midway between the larger vessels. The two or three stigmata of each row nearest the endostyle become successively shorter as that organ is approached.

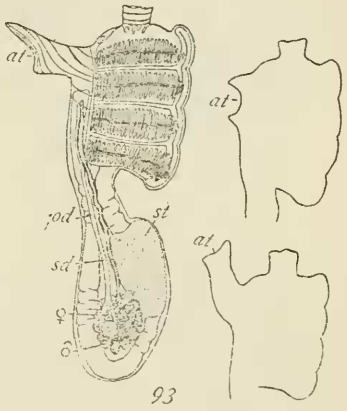


FIG. 93.—HOLOZOA VALLII (HERDMAN). ZOOID. × 20. ALSO OUTLINE OF THORAX OF TWO OTHER ZOOIDS SHOWING VARIATION IN FORM OF ATRIAL ORIFICE.

Stomach rather elongate oval, tapering toward the pyloric end. In most colonies it is smooth-walled, but in some colonies more or less distinct longitudinal ridges on the inner surface can be detected.

Intestinal loop generally not twisted, and the reproductive organs in consequence lie in the right side of the abdomen. The male organs consist of a group of about a dozen small pyriform or rounded testes arranged in a circle or hemispherical group, the stout thick-walled common sperm duct accompanying the ascending part of the intestine and rectum. The ovary is a small sac containing a few eggs, lying beside, or more or less surrounded by, the group of testes; the oviduct accompanies the sperm duct and ascending branch of the intestine. No brood pouches were found, though some large larvae were present in the test in one of the colonies. Probably brood pouches are formed in the usual manner, and the larvae observed had made their escape by the rupture or degeneration of the wall of the pouch.

This species was obtained at five stations, all in shallow water, in the Sulu Archipelago, where it appears to be common.

No. 49. Station D5141 (off Jolo Light, Feb. 15, 1908, 29 fathoms, coral sand). One colony. (Cat. No. 5905, U.S.N.M.)

No. 39. Station D5139 (off Jolo Light, Feb. 14, 1908, 20 fathoms, coral sand). Several colonies. (Cat. No. 5907, U.S.N.M.)

No. 36. Station D5147 (off Sulade Island, Sulu Archipelago, Feb. 16, 1908, 21 fathoms, coral sand and shells). One small colony. (Cat. No. 5925, U.S.N.M.)

No. 115. Station D5148 (off Sirun Island, Sulu Archipelago, Feb. 16, 1908, 17 fathoms, coral sand). Two large colonies. (Cat. No. 5975, U.S.N.M.)

Nos. 58, 65, 134. Station D5149 (off Sirum Island, Sulu Archipelago, Feb. 18, 1908, 10 fathoms, coral and shells). Five colonies. (Cat. Nos. 5906, 5908, and 5974, U.S.N.M., respectively.)

Herdman (1886) describes this species (which he himself suggests is none too well distinguished from the previously described Mediterranean forms *H. pileata*, O. Schmidt, 1862, and *H. rosea* Della Valle, 1881), from latitude 6° 54′ N.; longitude 122° 18′ E., 10–20 fathoms. He also reports it from Tangier Bay, Morocco, 35 fathoms.

Genus SYCOZOA Lesson, 1830.

[=*Colella* Herdman, 1886, part.]

SYCOZOA PULCHRA (Herdman), 1886.

1886. *Colella pulchra* Herdman, Rep. Voy. *Challenger*, vol. 14, Tuniacta, p. 106, pl. 15, figs. 1–3.

1891. *Colella pulchra* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 611.

1893–1907. *Colella pulchra* Seeliger, Bronn's Tier-reich, vol. 3, suppl., pl. 38, fig. 2.

1898. *Colella pulchra* Herdman, Ann. Mag. Nat. Hist., ser. 7, vol. 1, p. 447.

1899. *Colella pulchra* Herdman, Cat. Australian Mus., Sydney, No. 17, pp. 70 and 112.

1909. *Colella pulchra* Caullery, Bull. Sci. France Belgique, vol. 42, pp. 38, 41.

1909. *Sycozoa pulchra* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1438.

1909. *Sycozoa pulchra* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 33.

1912. *Sycozoa pulchra* Hartmeyer, Deutsche Südpolar Exped., vol. 12 Zool., pt. 4, p. 499.

In the only specimen the colony is of inverted conical form, measuring about 14 mm. across the top, which is only slightly convex, and 17 mm. in height, exclusive of the pedicel on which it is borne. The pedicel is 3 to 4 mm. in diameter and about 34 mm. long in its present condition, but the base has evidently been broken off.

Test opaque yellowish gray in color and somewhat fibrous in consistency. Zooids numerous, arranged in vertical parallel rows on

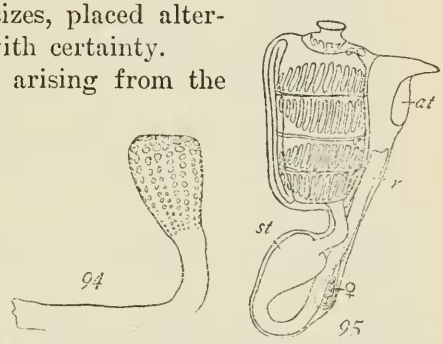
the sides of the colony, but with less obvious regularity on the top. The common cloacal ducts run vertically between every second row of zooids and probably all converge to one common cloacal aperture on the top of the colony.

Zooids small (not usually over 1.25 mm. long in the preserved state); the largest and oldest are in the upper part of the colony. Branchial aperture small, often only slightly prominent; unlobed. Atrial aperture a large opening whose anterior border may be produced into a short languet.

Mantle thin and transparent. Its musculature is only slightly developed and is mostly confined to the thorax, being composed chiefly of very delicate bands having a transverse or oblique direction or encircling the apertures, but these bands are few and very slender.

Only eight tentacles of two sizes, placed alternately, could be demonstrated with certainty.

Dorsal languets rather small, arising from the transverse vessels a little to the left of the median dorsal vessel. Branchial sac large, with four rows of stigmata. The rows are arranged in pairs, the first and second separated only by a narrow transverse vessel, and the third and fourth rows also, while between the second and third rows a wider vessel intervenes. There are 14 or 15 stigmata in a row on each side in the two anterior rows and one or two less in the posterior ones.



FIGS. 94, 95.—SYCOZOA PULCHRA (HERDMAN). 94, COLONY. × .75. 95, ZOOID. × 30.

Intestinal loop small; generally not twisted. Stomach small, pear shaped, tapering toward the pyloric end, and smooth walled. Margin of anus slightly two lipped.

Only female reproductive organs were found, though many zooids were examined, and these were not greatly developed. They consist of a saclike ovary containing a few eggs lying in the dorsal region of the abdomen close against the ascending part of the intestinal loop. The largest eggs are in the posterior part of the ovary; the anterior end of the latter appears to be continuous with an oviduct accompanying the intestine. No incubatory pouch was found, but its absence may have been due to immaturity of the colony as a whole and of the individual zooids.

The only specimen (No. 25) (Cat. No. 5926, U.S.N.M.) is from station D5149 (off Sirun Island, Sulu Archipelago, Feb. 18, 1908,

10 fathoms, coral and shells). The *Challenger* Expedition obtained the types in latitude 10° 36′ S.; longitude 141° 55′ E., 6 fathoms. The *Siboga* Expedition (Sluiter, 1909) obtained it at several stations in the vicinity of latitude 6° S.; longitude 114° E., 80 meters.

Genus NEPHTHEIS Gould, 1856.

[=*Oxycorynia* von Drasche, 1883.]

NEPHTHEIS THOMPSONI (Herdman), 1886.

Plate 24, fig. 4.

1856. *Nephtheis* (?), Gould, Mollusca and Shells (U. S. Exploring Exped., under Wilkes), Atlas, p. 16, figs. 621–621*b*.

1886. *Colella thompsoni* Herdman, Rep. Voy. *Challenger*, vol. 14, Tuniacta, p. 94, pls. 10–13.

1891. *Colella thompsoni* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 611.

1907. *Oxycorynia thompsoni* Michaelsen, Hamburg Magalhaenisch. Sammelreise, vol. 1, p. 8.

1908. *Nephtheis*, sp. Hartmeyer, Zool. Annalen, Würzburg, vol. 3, p. 51.

1909. *Oxycorynia thompsoni* Caullery, Bull. Sci. France Belgique, vol. 42, pp. 46, 38, 40.

1909. *Nephtheis thompsoni* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 36.

1909. *Nephtheis thompsoni* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1440.

Colony consisting of one or more heads each raised on a long narrow pedicel and somewhat suggesting in its shape and appearance an elongated pine cone. When composed of more than one head the several pedicels may arise from a common basal mass of test, or one or more smaller heads may be borne on branches arising at different points from the pedicel of the principal head. Zooids present only in the heads, the largest and most mature being in the upper part of the colony. The thorax of each well-developed zooid projects somewhat above the general surface of the common test even in the contracted preserved specimens, and doubtless does so much more in the living state, especially when the zooids are expanded. The pedicels are not of uniform diameter throughout their length. In general they become larger toward the lower end, expanding somewhat abruptly into a basal mass of test, by which the colony is attached. Surface of the pedicel fairly smooth or slightly wrinkled, free from incrusting material.

Dimensions of three large colonies (each consisting of only a single head with pedicel):

Locality.	Station D5139.	Station D5139.	Station D5145.
	mm.	*mm.*	*mm.*
Total height of colony	182	190	97
Height of head	72	90	40
Length of pedicel	110	100	57
Transverse diameter of head	21	25	20
Average diameter of pedicel, about	11	11	7

Test in the heads more or less transparent, free from pigment in some specimens; in others there is more or less greenish and brownish pigment in rounded cells, these occurring also in the mantles of the zooids. In some of the colonies most of the zooids have four small dark spots on the anterior part of the thorax. In the pedicels the test is tougher and less transparent, but free from pigment cells.

Zooids very variable in size, not only in different specimens and in different states of contraction but also in different parts of the same colony. Some of them are 14 mm. or more long in the preserved and only moderately expanded condition, but in small, and especially in immature colonies they are all much smaller, not exceeding one-third or one-half this length. A constricted neck of moderate length separates the abdomen from the large and considerably elongated thorax, and a large vascular process extends from the posterior end of the abdomen. The vascular processes of the zooids form an anastomosing network in the pedicel. The buds appear to form from the extreme upper branches of this network. Anterior end of the body obliquely truncated so that the dorsal side of the thorax is longer than the ventral side; the anterodorsal region is produced into a large atrial siphon of variable length bearing the small round atrial aperture close to or at its end. The branchial aperture is situated on the oblique anterior end of the thorax and is scarcely at all prominent, but is of larger diameter than the atrial. Neither aperture lobed. When the zooids are in position in the colony the atrial siphon of each zooid extends above the general surface of the colony toward the apex of the latter.

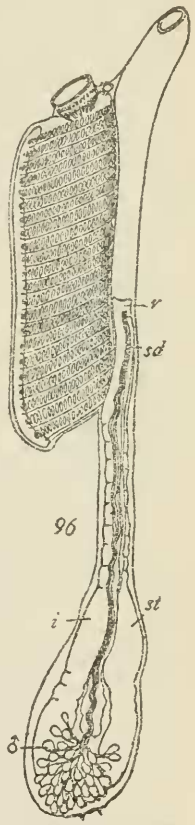


FIG. 96.—NEPHTHEIS THOMPSONI (HERDMAN). ZOOID. × 25.

Mantle thin, provided with many narrow rather regularly spaced transverse muscle bands in the thorax. These bands are generally quite conspicuous.

Tentacles numerous, of 3 sizes. The largest and medium sized ones alternate in one circle; the numerous small ones form another circle nearer the branchial aperture.

Dorsal languets triangular, continuous laterally with rather broad membranes which are borne on the transverse vessels of the branchial sac. The languets arise directly from the medium dorsal vessel.

Branchial sac with 20 or more rows of stigmata with about 25 stigmata in a row on each side.

Stomach narrow and not very conspicuous; its walls not plicated. Intestine forming a rather long loop of large diameter.

Nearly all the zooids examined, including those from different colonies, had the male reproductive organs well developed. They consist of numerous (often 30 to 50) small pear-shaped testes lying beside the posterior part of the intestinal loop and often extending beyond it to the extreme posterior end of the body. They discharge into a stout common sperm duct (which accompanies the intestine) by means of small ducts. The ovary was not satisfactorily made out in any case, unless it is represented by a saclike structure almost empty in most of the zooids studied, situated beside the intestinal loop just anterior to the group of testes. This sac appears to extend into a tube, presumably the oviduct, which accompanies the ascending branch of the intestine.

Many of the zooids possess a small hernialike incubatory pouch containing a few (usually 4 to 6) developing embryos. The pouch is situated at or near where the thorax and the constricted neck attaching the abdomen join, and it contains an enlarged loop of the oviduct within which the embryos remain and undergo part of their development. One or more large tailed larvæ are often also present in the atrial cavity of the same zooid.

The localities of the specimens are:

No. 104. Station D5139 (off Jolo Light, Feb. 14, 1908, 20 fathoms, coral sand). Four large colonies. (Cat. No. 5992, U.S.N.M.)

Nos. 28, 52. Station D5145 (near Jolo Light, Feb. 15, 1908, 23 fathoms, coral sand and shells). Four colonies. (Cat. Nos. 5973 and 5915, U.S.N.M., respectively.)

No. 50. Station D5149 (off Sirun Island, Archipelago, Feb. 18, 1908, 10 fathoms, coral and shells). One small colony. (Cat. No. 5914, U.S.N.M.)

No. 35. Station D5165 (off Observation Island, Tawi Tawi Group, Sulu Archipelago, Feb. 24, 1908, 9 fathoms, coral). One specimen comprising a number of heads, all small. (Cat. No. 5913, U.S.N.M.)

No. 79. Some small degenerate fragments from station D5136 (near Jolo Light, Feb. 14, 1908, 22 fathoms, sand and shells) are also probably of this species. (Cat. No. 5916, U.S.N.M.)

This species was figured by Gould (1856) from a specimen from the "Sooloo Sea." He gave it a generic name (*Nephtheis*) but no specific name. A closely related species was afterwards described by von Drasche (1882) from the Caroline Islands under the name *Oxycorynia fasciculatis*. The writer follows Hartmeyer (1909) in adopting Gould's generic name. The *Challenger* Expedition collected it in latitude 6° 54′ N.; longitude 122° 18′ E., 10 fathoms, and it was described and figured in great detail by Herdman (1886).

It was also obtained by the *Siboga* Expedition in latitude 8° 23.5′ S.; longitude 119° 4.6′ E., 64 meters. (Sluiter, 1909.) Caullery (1909, p. 46) evidently inadvertently attributes the above species *N. fascicularis* of von Drasche to the Philippines. It has not been found there, unless *N. thompsoni* should eventually prove to be identical with von Drasche's *fascicularis*.

Family DIDEMNIDAE Verrill, 1871.

Genus DIDEMNOPSIS Hartmeyer, 1903.

DIDEMNOPSIS JOLENSE, new species.

Colony of elongate outline and rather thin flattened form in the only good specimen. Length, 24 mm.; greatest width, 10 mm.; thickness, 4 to 5 mm. Test rather easily torn, translucent, of a light, smoky brown color, due both to pigment cells in the test and thoracic region of the mantle, and to diffused color in the test and tissues of the zooids. No spicules; zooids arranged in curved rows probably constituting only a few systems, or perhaps only one.

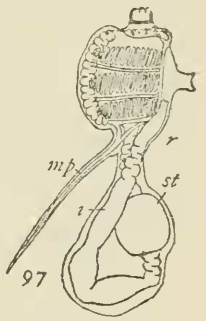


FIG. 97.—DIDEMNOPSIS JOLENSE, NEW SPECIES. × 17.5.

Zooids rather large, up to 3 mm. long in the partially contracted preserved state. Body strongly constricted between the thorax and abdomen; a very long strong tapering muscular process extends obliquely ventrally and posteriorly out into the test from this constricted region; club-shaped vascular processes also extend into the test from some zooids. Branchial aperture 6-lobed, and provided with a strong sphincter; atrial aperture plain or very obscurely lobed; situated at the end of a very short tubular extension of the middle dorsal region of the thorax, or in some cases scarcely produced at all. No atrial languet.

Mantle muscles composed chiefly of longitudinal fibers on the thorax; not conspicuous on the abdomen.

Tentacles apparently of three sizes. The writer was not successful in counting them, on account of the strongly contracted state of the throax in all the zooids examined.

Dorsal languets not demonstrated for the same cause, though there is no reason to doubt their presence.

Only three rows of stigmata could be discovered; there are probably at least 15 in a row on each side.

Stomach rounded-oblong, intestinal loop rather large, with several valvelike constrictions in the proximal region of the intestine.

No reproductive organs found in any of the numerous zooids examined. The colony, however, contains some larvae.

The type and only certain specimen (No. 27) (Cat. No. 6040, U.S.N.M) is from station D5137 (near Jolo Light, Feb. 14, 1908, 20 fathoms, sand and shells). Another small colony (No. 68) (Cat. No. 5926, U.S.N.M.) in the collection may be of this species, though the specimen is insufficient to be the basis of a certain conclusion. The differences which it exhibits may be due to age or different conditions of growth or different degree and manner of contraction in preservation. The colony consists of several minute lobes. This is, however, perhaps due to growing on a branching hydroid or bryozoan instead of on a broad surface. The test is not pigmented, but the tissues of the zooids are dark colored. As compared with the specimen just described the zooids have the branchial orifice with shorter (sometimes scarcely noticable) lobes, the atrial tube longer, and the long muscular process wanting, or at least not conspicuously developed. This latter difference may be more or less dependent on the small and lobed condition of the colony, no such large firm mass of test being present for muscular attachment as in the last-described specimen. Club-shaped vascular processes of the middle region of the zooids are, however, well developed. No reproductive organs could be demonstrated. The specimen is from station D5250 (near Linao Point, Gulf of Davao, May 18, 1908, 23 fathoms, coral and sand).

Genus DIDEMNUM Savigny, 1816.

[=*Leptoclinum* Authors.]

DIDEMNUM GRANDE (Herdman), 1886.

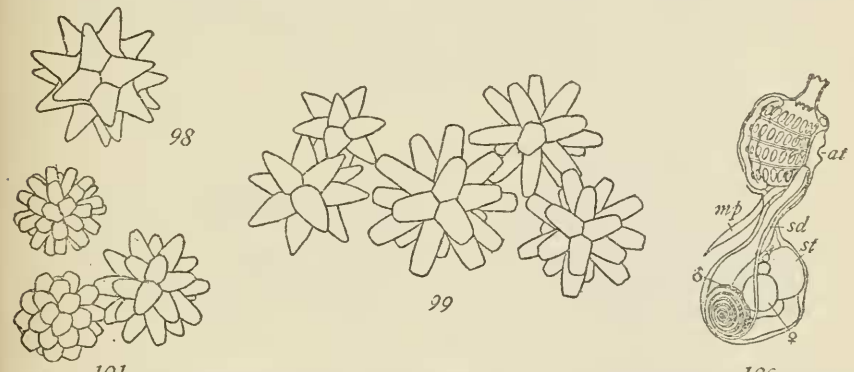
Plate 30, figs. 20–23.

1886. *Leptoclinum albidum*, var. *grande* Herdman, Rep. Voy *Challenger*, vol. 14, Tunicata, p. 291, pl. 35, figs. 11–14.
1909. *Didemnum albidum*, var. *grande* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1449.
1910. *Leptoclinum albidum*, var. *grande* Van Name, Proc. Boston Soc. Nat. Hist., vol. 34, p. 374.

Colony of comparatively thin incrusting form, its shape depending largely on the object on which it grows. Though rarely much exceeding an average thickness of 3 mm., it forms colonies of considerable extent, some of the specimens measuring 50 to 60 mm. in greatest diameter. There is also one large colony or group of confluent colonies from station D5148 which grew upon a slender branching hydroid, enveloping and binding together its branches in such a way that the ascidian colony has taken the form of a sponge-like mass perforated by canals, clefts, and passages, which must, when entire, have been at least 120 mm. in greatest diameter. It is probable that the peculiarities of this colony are due to the form

of the object on which it grew, not to any difference of species. Color usually chalky or yellowish white. In specimens from two stations (D5139 and D5154) the upper or free surface of the colony is somewhat mottled with a blackish pigment. The branchial apertures of the zooids appear in the contracted preserved specimens as minute depressions, and in some specimens are quite conspicuous. Common cloacal apertures are only occasionally recognizable, but are apparently generally rather numerously distributed over the surface. Spicules are abundant in most parts of the colonies, often to an extent rendering the test hard and brittle.

The spicules are mostly considerably larger than in *Didemnum ternatanum*, well developed ones averaging 0.027 to 0.038 mm. in diameter, or in some colonies larger (0.04 to 0.05 mm.). They are stellate; their rays rather few and long, regularly tapering in some



FIGS. 98–101.—DIDEMNUM GRANDE (HERDMAN). 98, TYPICAL SPICULE. × 700. 99, COMMON FORMS OF SPICULES. × 700. 100, ZOOID. × 32. 101, SPICULES FROM COLONY FROM STATION D5145. × 700.

colonies, in others usually more nearly cylindrical and truncated at the tip (figs. 98 and 99).

Zooids greatly contracted in nearly all the specimens so that the determination of their structure is difficult. In their contracted and preserved state they often do not exceed 1 mm. in length; they are numerous and closely placed in the colony. Branchial aperture with 6 small lobes; atrial aperture neither produced into a tube nor provided with a languet.

Mantle musculature mainly longitudinal, forming distinct bands on the thorax. A muscular process extending into the test from the constricted middle portion of the body is present.

Dorsal languets apparently arising from the transverse vessels a little way to the left of the median dorsal vessel.

Stigmata in four rows, rather few in number; in one zooid 9 or 10 in a row on each side were demonstrated in the three anterior rows, and 8 in the last or posterior row.

No deviations from the type usual in this genus were observed in the digestive or reproductive organs. The latter were not developed in most of the zooids examined, and none were found in which it could be determined whether the testis is single or composed of two glands, as is the case in many closely related forms. The vas deferens makes several spiral turns about the testis.

This species is sufficiently well represented in the collection to indicate that it is common in the southern part of the Philippine region if the writer is correct in including all the following specimens in this species.

No. 8. Station D5128 (off Nogas Island, Feb. 4, 1908, reef). One colony (Cat. No. 5883, U.S.N.M.).

No. 100. Station D5139 (off Jolo Light, Feb. 14, 1908, 20 fathoms, coral sand). Many large colonies (Cat. No. 5989, U.S.N.M.)

Nos. 11 and 12. Station D5145 (near Jolo Light, Feb. 15, 1908, 23 fathoms coral sand and shells). Three very small colonies (Cat. Nos. 5885 and 5888, U.S.N.M., respectively).

Nos. 9 and 13. Station D5136 (near Jolo Light, Feb. 14, 1908, 22 fathoms, sand and shells). Several small colonies (Cat. Nos. 5887 and 5990, U.S.N.M., respectively).

No. 6. Station D5148 (off Sirun Island, Sulu Archipelago, Feb. 16, 1908, 17 fathoms coral sand). Parts of one, or perhaps of several very large colonies (Cat. No. 5985 U.S.N.M.).

Station D5149 (off Sirun Island, Sulu Archipelago, Feb. 18, 1908, 10 fathoms, coral and shells). Small colonies.

No. 13. Station D5150 (off Sirun Island, Sulu Archipelago, Feb. 18, 1908, 21 fathoms, coral sand and shells). One colony (Cat. No. 5884, U.S.N.M.).

No. 10. Station D5154 (near Bakun Point, Tawi Tawi Group, Sulu Archipelago, Feb. 19, 1908, 12 fathoms, coral sand). Two colonies (Cat. No. 5886 (U.S.N.M.).

Herdman's type was a large colony obtained by the *Challenger* expedition off Zebu, Philippines, in 95 fathoms. The writer has made it clear in a previous article (1910, p. 374) that the present form has nothing to do with *Leptoclinum albidum* Verrill, 1871. It seems best therefore to give the form the rank of a species, though it must be admitted that it is very close to Savigny's original type of the genus, *Didemnum candidum* (Savigny, 1816, pp. 14 and 194, pl. 4, fig. 3; pl. 20, fig. 1) from the Gulf of Suez, and it seems not unlikely that this and a number of other species of this genus from tropical and subtropical seas will eventually have to be united with Savigny's species.

There are two other colonies in the *Albatross* collection both of a chalky white color and densely crowded with spicules; that the writer also refers to this species, though the spicules lack the regularity in the form of the points or rays which is so characteristic of the specimens just described. The rays are numerous, sometimes sharp, sometimes irregularly blunted; the spicules resembling, in fact, those

of *Didemnum ternatanum* except for their larger size. (See fig. 101.) These colonies are from:

No. 7. Station D5145 (near Jolo Light, Feb. 15, 1908, 23 fathoms, coral, sand, and shell). Rather large colony (pl. 30, fig. 23) (Cat. No. 5882, U.S.N.M.).

No. 15. Station D5147 (off Sulade Island, Sulu Archipelago, Feb. 16, 1908, 21 fathoms, coral, sand, and shells). (Cat. No. 6022, U.S.N.M.)

A rather large colony received from the University of the Philippines and collected by Dr. L. E. Griffin and Mr. L. D. Wharton at Bantayan has similar spicules.

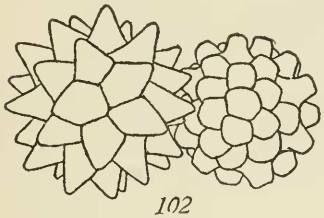
DIDEMNUM MOSELEYI (Herdman), 1886.

1886. *Leptoclinum moseleyi* Herdman, Rep. Voy. *Challenger*, vol. 14, Tunicats, p. 272, pl. 37, fig. 9–14.

1898. *Leptoclinum moseleyi* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 631.

1909. *Didemnum moseleyi* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 45.

1909. *Didemnum moseleyi* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1450.



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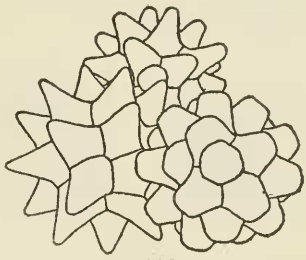


103

Figs. 102, 103.—Didemnum moseleyi (Herdman). 102, Spicules from colony from Station D4145. × 700. 103, Spicules from colony from Station D5145. × 700.

Specimens from two localities appear to belong to this species of Herdman's, although they are proportionately thicker and less densely crowded with spicules than those on which his description was based. From station D5145 there is in addition to a very small colony, one apparently originally at least 30 mm. in diameter growing upon a branching coral. It is of a light brownish color becoming paler at the margin. From station D5174 there is a larger colony of a uniform buff color surrounding a calcareous worm tube for a length of 75 mm. and attaining a thickness of 5 mm. or 6 mm. in some places. Spicules very abundant in the superficial layer of the colonies, but much fewer in the interior portions. The small 6-lobed branchial apertures of the numerous and closely placed zooids are quite conspicuous, especially in the largest colony. Common cloacal apertures, when distinguishable, small and irregularly lobed. They are probably quite numerous. Surface of colonies fairly smooth and even, but not shiny. Spicules mostly between 0.024 mm. and 0.032 mm. in diameter, spherical with very numerous short

points, which may be sharp and conical or more or less truncated or rounded off.

Zooids closely resembling those of *D. grande*. They are small (about 1 mm. long in their contracted state) and have a tapering muscular process extending out into the test from the constricted neck connecting the thorax and abdomen. Branchial siphon rather large, with six short triangular lobes. It is lined with test substance which may contain spicules.

Tentacles of three sizes.

Branchial sac with four rows of stigmata, eight on each side in the anterior rows and 7 in the last row.

Dorsal languets arising from the transverse vessels a little way to the left of the median dorsal vessel.

No pecularities noted in the digestive organs.

No reproductive organs found in the zooids examined.

The above-described specimens are from:

No. 16. Station D5145 (near Jolo Light, Feb. 15, 1908, 23 fathoms, coral sand and shells). Two colonies (Cat. No. 5880, U.S.N.M.).

No. 18. Station D5174 (off Jolo Light, Mar. 5, 1908, 20 fathoms, coarse sand). One large colony (Cat. No. 5881, U.S.N.M.).

Herdman (1886) described the species from Zamboanga, Mindanao, 10 fathoms. Sluiter (1909) records it from one station in the Sulu Archipelago (latitude 6° 7.5′ N.; longitude 120° 26′ E., 16–23 fathoms) and from other localities in the Malay Archipelago.

DIDEMNUM TERNATANUM (Gottschaldt), 1898.

Plate 28, fig. 16; plate 29, fig. 17; plate 30, figs. 24 and 25; plate 33, fig. 44.

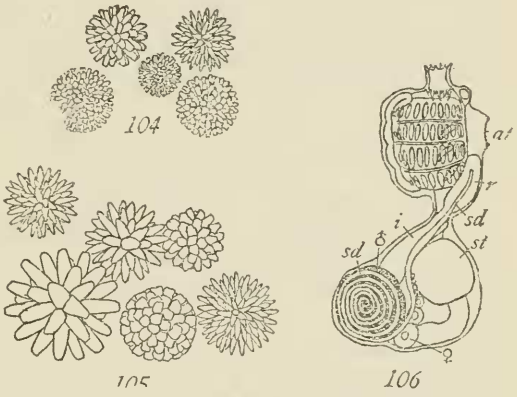
1898. *Didemnum ternatanum* Gottschaldt, Abh. Senckenburg. Gesell., vol. 24, p. 648, pl. 35, fig. 1.

1909. *Didemnum ternatanum* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1451.

Though subject to much modification in shape, due to the position in which it grows and the form of the object to which it is attached, this species is generally recognizable by the thick, fleshy, cushionlike, dome-shaped, or obtusely conical colony with a single large common cloacal aperture at the highest point. The zooids of such a colony, even when it is large, therefore form a single very complex system. This makes necessary large branching cloacal canals in the superficial parts of the colony, and these, together with the rather soft, weak character of the test substance, render the colonies more fragile and more easily torn (especially in the superficial parts) than those of related species described in this paper. When a colony has a base of irregular or elongated form there may be two or three common cloacal apertures, and these are then commonly on distinct elevations or prominences. In some colonies, the courses of the common cloacal

canals can be traced by slight furrows or darker lines on the surface, in others there are no such indications of them.

Spicules noteworthy for their smallness in most specimens, generally ranging from 0.008 to 0.028 mm. in diameter. In some colonies the larger spicules will scarcely average over 0.01 mm. in diameter; in others they may average 0.02 mm. or even more. In some colonies from station D5136 the spicules are unusually large, many of them measuring 0.03 mm. or over. In form they are usually better described as burr-like rather than stellate, on account of the large number of points or rays with which they are provided, or, more strictly speaking, of which they are composed, but in some colonies the prevailing type of spicules has fewer rays. The points are often narrow and sharp (though they never exhibit the regularity and perfect conical form that is frequent in some members of this genus), but in most colonies they are mostly irregularly blunted at the tips and often so short that the spicule has nearly a spherical form (see fig. 105). Spicules generally very numerous in the surface layer of the test, becoming less numerous and disappearing entirely in the deep portions of the colony, where (beneath the zooids and the cloacal canals) the test is solid and translucent though rather soft and easily torn. Some colonies, however, have few spicules, even in the superficial parts.



FIGS. 104–106. — DIDEMNUM TERNATANUM (GOTTSCHALDT). 104, SPICULES FROM A COLONY FROM ULUGAN BAY. × 700. 105, SPICULES FROM A COLONY FROM STATION D5136. × 700. 106, ZOOID. × 25.

Color of the alcoholic specimens generally buff, often with a purplish tinge or some shade of purplish brown or light brown, but many of the specimens have the superficial layer of the upper surface darker, due to the presence of rather large pigment cells in this layer. These are occasionally so numerous and deeply pigmented as to give the upper surface a dark-brown color (very dark in two colonies from station D5144). In some conspicuously pigmented colonies the edges of the colony and the border of the large common cloacal aperture or apertures are practically free from pigment and are light colored, in more or less conspicuous contrast to the rest of the upper surface. The minute closely placed branchial apertures of the zooids are usually quite conspicuous on the surface. Large elongated and irregu-

larly shaped colonies measure as much as 50 to 60 mm. in diameter at the base in one direction and may attain a maximum thickness perpendicular to the base of about 30 mm. in the part where the common cloacal aperture is situated. When young the colonies are comparatively thin and flattened.

Zooids of moderate size, the individual figured (fig. 106), which was moderately well expanded, measured about 1.5 mm. long in the preserved condition. The body is strongly constricted between the thorax and abdomen, but a muscular process extending out into the test is apparently not developed, perhaps because, owing to the extensive development of the common cloacal canals, the test is much reduced in amount in that layer of the colony where the zooids are situated, most of the zooids being only separated from the adjacent canals by a thin septum of test substance. Branchial aperture with six small lobes; atrial aperture with a thin margin which invariably becomes torn in dissecting out the zooids, so that its shape is difficult to determine, but a careful examination of many zooids failed to disclose the existence of any atrial languet.

Mantle musculature very slight.

Tentacles of three orders regularly arranged.

Dorsal languets arising from the transverse vessels of the left side, but rather near the median dorsal vessel.

Stigmata in four rows; the number in a row on each side in several fully developed zooids was found to be as follows:

Row	1	2	3	4
Number of stigmata	11	11	10 or 11	8 or 9

No peculiarities were noted in the digestive or reproductive organs except that the testes appeared in some specimens to be partially divided by obscurely indicated radial clefts or furrows into four lobes. In most of the zooids the proximal part of the sperm duct makes many spiral turns (6 to 8) about the testis.

If the number of localities, as well as the quantity of material collected at many of them can be taken as a safe indication, this is the most abundant and generally distributed ascidian in the Philippine region. It was obtained at the stations and places listed below, and in addition there is one lot (No. 156) (Cat. No. 5982, U.S.N.M.) not labeled with a locality. It grows on coral, shells, eel grass, other ascidians, etc., in shallow water.

No. 97. Station D5218 (off Anima Sola Island, Apr. 22, 1908, 20 fathoms, coarse sand.) One very small colony.

No. 120. Ulugan Bay, Palawan, December 29, 1908. Two large colonies (Cat. No. 5981, U.S.N.M.).

No. 66. Surigao, Mindanao, May 8, 1908. One large colony (Cat. No. 5889, U.S.N.M.).

No. 129. Mantacao Island, coast of Bohol, April 8, 1908, reef. Large colony (Cat. No. 5983, U.S.N.M.).

No. 85. Marongas Island, Jolo, February 10, 1908. Two small colonies (Cat. No. 5892, U.S.N.M.).

No. 101. Jolo, Jolo Island, February 11, 1908. ("From interior of a pearl oyster.") One colony (Cat. No. 5984, U.S.N.M.).

Nos. 69, 81, 98 (doubtful specimen), and 198. Station D5139 (off Jolo Light, Feb. 14, 1908, 20 fathoms, coral sand.) Many colonies, some large (Cat. Nos. 5862, 5891, 5986, and 5987, respectively, U.S.N.M.).

Nos. 59 and 61. Station D5144 (off Jolo Light, Feb. 15, 1908, 19 fathoms, coral sand). Two deeply pigmented colonies (Cat. Nos. 5894 and 5896, respectively, U.S.N.M.).

Nos. 113 and 155. Station D5136 (near Jolo Light, Feb. 14, 1908, 22 fathoms, sand and shells). Many colonies, some large (Cat. Nos. 5994 and 5979, respectively, U.S.N.M.).

No. 56. Station D5149 (off Sirun Island, Sulu Archipelago, Feb. 18, 1908, 10 fathoms, coral and shells). One deeply pigmented colony (Cat. No. 5890, U.S.N.M.).

No. 109. Station D5154 (near Bakun Point, Tawi Tawi Group, Sulu Archipelago, Feb. 19, 1908, 12 fathoms, coral sand). Two large colonies (Cat. No. 5988, U.S.N.M.).

No. 32. Station D5557 (off Cabalian Point, Jolo Island, Sept. 18, 1909, 13 fathoms, sand and coral). One colony (Cat. 5895, U.S.N.M.).

Nos. 41 and 74. Station D5165 (off Observation Island, Sulu Archipelago, Feb. 24, 1908, 9 fathoms, coral). Small colonies (Cat. Nos. 5897 and 5893, respectively, U.S.N.M.).

There are also specimens of this species in the United States National Museum collected at Porta Galera Bay, Mindoro, by S. F. Light, and at Bantayan by Dr. L. E. Griffin and Mr. L. D. Wharton. The latter, though of the usual brown shades in preservation, are recorded as "soft green" in color when fresh. Perhaps this is the usual color of fresh specimens.

Gottschaldt (1898) described this species from numerous specimens taken at Ternate.

Genus POLYSYNCRATON Nott, 1892.

As already noted by Sluiter (1909), the propriety of including the following species in this genus seems doubtful, as it has the atrial aperture produced into a tube and lacks an atrial languet. In Nott's (1893) original species the atrial aperture is not produced, and a languet is present. In common with Nott's species, however, it has the testis cleft into a number of entirely distinct glands, a spirally coiled sperm duct, and four rows of stigmata.

POLYSYNCRATON DUBIUM Sluiter, 1909.

Plate 31, fig. 30; plate 32, fig. 43; plate 33, fig. 49.

?1856. *Eucoelium erubescens* Gould, U. S. Exploring Exped., Mollusca and Shells, Atlas, pl. 53, fig. 615.

?1906. *Leptoclinum margaritiferae* Herdman, Rep. Ceylon Pearl Oyster Fisheries. Suppl. Rep. No. 39, p. 337, pl. 8, figs. 19–22; pl. 9, fig. 7.

?1909. *Didemnum margaritiferae* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1450.

1909. *Polysyncraton dubium* SLUITER, *Siboga*-Exped., vol. 56*b*, p. 69, pl. 4, figs. 3 and 3*a*; pl. 7, fig. 10.

1912. *Polysyncraton dubium* HARTMEYER, Deutche Tiefsee Exped., vol. 16, p. 325.

Colony flat and incrusting, but rather thick and fleshy. Surface fairly smooth and even except in a specimen from station D5136, in which it has deep convoluted furrows, and in one from station D5555, in which it is raised into low rounded elevations separated by furrows. Exterior of the colony varying from smooth and shiny to minutely granular, according to the abundance of spicules in the superficial part. Branchial orifices of the zooids conspicuous where the spicules are abundant, but less noticeable where they are scarce. Common cloacal orifices when distinguishable large and few in number, sometimes apparently only one or two for the entire colony. Color a pale, slightly reddish buff, except in the case of one specimen from station D5150, which is blackish, owing to the abundant presence of bluish-black pigment, contained chiefly in irregular elongated branching cells in the test. Greatest diameter of largest colony, 59 mm. Thickness usually ranging from 3 mm. to 8 mm., but in some places it may be less or greater than these measurements. One specimen (from station D5145) grew on the shell of a small living crab, arching over and inclosing the carapace so as to leave only the limbs and mouth parts uncovered.

Test yellowish, gelatinous, but moderately tough; its cells free from conspicuous pigment except in the specimen above mentioned. Bladder cells abundant. Spicules few in the interior and lower portions of the colonies, but often very thickly distributed in the superficial layer. They are usually mostly moderately large, 0.25 to 0.04 mm. in diameter, and the typical form appears to be regularly stellate, with a moderate number of smoothly tapering conical points ending in fairly sharp extremities. Such spicules are the chief kind occurring in the colonies from stations D5150 and D5139. In the colony from station D5145 they are accompanied in some parts of the test by spicules with more or less blunted or truncated rays, while in the colonies from stations D5174 and D5555 none of the spicules have the regular conical points, the points being in all cases more or less truncated, or at least not of regularly tapering conical form. In the last two cases the rays of the spicules are very much more numerous than in the others. The spicules in the colony from station D5174 average smaller than the usual dimensions; in that from station D5555 they average larger, many reaching 0.05 mm. in diameter. These different forms of spicules are shown in figure 107.

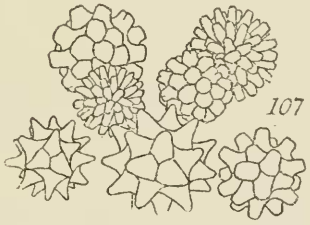
Zooids over 2 mm. long when fully expanded, but in the preserved specimens generally less. Branchial siphon usually quite long, with six more or less evident lobes. Atrial orifice round, on a short tube or siphon arising from the posterior dorsal part of the thorax, and usually directed dorsally or dorsally and posteriorly. Muscular or vascular processes extending out into the test were not demonstrated.

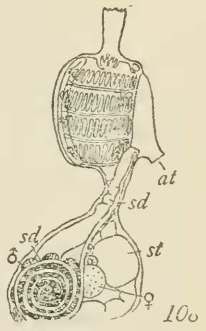
Mantle musculature rather delicate; a moderate number of slender longitudinal bands are present on the thorax.

Four large tentacles in addition to two orders of smaller ones, probably about 16 in all, are present.

Dorsal languets arising from the transverse vessels of the left side, the width of two or three stigmata to the left of the median dorsal vessel.

Four rows of stigmata; 15 in the two anterior rows, 14 in the third, and 12 or 13 in the posterior row on each side.





FIGS. 107, 108.—POLYSYNCRATON DUBIUM SLUITER. 107, SPICULES SHOWING VARIATIONS IN FORM. × 500. 108, ZOOID. × 21.

No peculiarities noticed in the digestive or female reproductive organs. Male reproductive organs were found in all except one of the colonies. There are from 9 to 12 separate pear-shaped testes communicating with the origin of the common sperm duct or vas deferens by very short connecting ducts. In the specimens from stations D5159, D5555, and D5139 the testes have a regular radial arrangement about the origin of the common sperm duct as a center, the duct making at least four or five spiral turns about the entire group of testes. In the specimen from station D5145 and D5174 the testes were evidently in an actively functional state and more or less distended and enlarged, so that they are crowded out of their radial arrangement and form a compact more or less hemispherical group, about which the sperm duct (also much distended with spermatozoa) makes only about two irregular turns. As it is evident that such a displacement of the testes and partial straightening of the sperm duct would be the natural result of dilation of these organs, the writer can not consider this peculiarity important in classification.

The above description shows that the writer has assigned to this species specimens differing among themselves a good deal in some of the minor characters. Possibly he has gone too far in this, and should have recognized more than one species, but the limited material

available does not seem to afford a secure basis for the latter course. The *Albatross* specimens were from the following stations, all in the Sulu Archipelago—one colony from each:

No. 4. Station D5139 (off Jolo Light, Feb. 14, 1908, 20 fathoms, coral sand (Cat. No. 6033, U.S.N.M.).

No. 5. Station D5145 (off Jolo Light, Feb. 15, 1908, 23 fathoms, coral sand and shells). Growing on the shell of a small living crab (Cat. No. 5900, U.S.N.M.).

No. 1. Station D5136 (off Jolo Light, Feb. 14, 1908, 22 fathoms, sand and shells).

No. 3. Station D5174 (off Jolo Light, Mar. 5, 1908, 20 fathoms, coarse sand) (Cat. No. 5901, U.S.N.M.).

No. 17. Station D5555 (off Cabalian Point, Jolo Island, Sept. 18, 1909, 34 fathoms, coarse sand) (Cat. No. 5996, U.S.N.M.).

No. 2. Station D5150 (off Sirun Island, Feb. 18, 1908, 21 fathoms, coral sand and shells). Colony differing from the remaining specimens in containing bluish-black pigment in the test (Cat. No. 6032, U.S.N.M.).

Sluiter (1909) described *P. dubium* from colonies obtained by the *Siboga* Expedition at Muaras Reef off Borneo, and at Kaniungan Ketjil (reef). As already indicated in the list of synonyms this species may perhaps be *Leptoclinum margaritiferæ* Herdman (1906) from Ceylon, but Herdman's description and figures are not sufficiently complete to settle the question. Another possibility is that it is *Eucoelium erubescens* Gould, 1856.

From station D5109 (25.8 miles off Corregidor Light, Jan. 15, 1908, 10 fathoms, coral) there is a small colony (No. 19) (Cat. No. 5899, U.S.N.M.), apparently closely related to the present species or possibly to be regarded as an abnormal example of it, which has undergone degeneration or has suffered by the oncoming of conditions unfavorable to its growth after it had attained a moderate size. It is about 20 mm. in greatest diameter and 4 mm. in thickness; its upper surface has very deep convoluted furrows separated by rounded ridges which contain few spicules and no zooids, and are practically colorless, while the basal part of the colony is densely crowded with spicules giving it a chalky-white color. The spicules are fairly large (0.03 to 0.04 mm. in diameter) and have a spherical form, the numerous blunt points or rays of which they are built up scarcely projecting above the surface of the sphere. Whether or not this condition may have resulted from the absorption of the projecting points of a type of spicule similar to those in the other specimens described above the writer will not attempt to decide; but it seems not unlikely that if abnormal conditions have affected the colony they may also have influenced the development of the spicules. The zooids measure about 1.2 mm. in length in a considerably contracted state. They are neither numerous nor are they present in all parts of the colony. Their poor preservation prevents the demonstration of many of the important points of their structure, but three orders of

tentacles (probably 16 in all) could be distinguished as in *P. dubium*, and the number and arrangement of the stigmata is evidently the same or nearly the same as in that species. An atrial siphon could not be demonstrated, but, on the other hand, there was no evidence against its presence. There are a number of separate testes which, though of fair size, are so poorly preserved and in such a soft condition that their exact number could not be determined. The vas deferens makes only a few turns about the compact group or mass which they form.

Genus LEPTOCLINUM Milne-Edwards, 1842.

[=*Diplosoma* Authors.]

LEPTOCLINUM MACDONALDI (Herdman).

1886. *Diplosoma macdonaldi* Herdman, Rep. Voy. *Challenger*, vol. 14, Tunicata, pt. 2, p. 315.
1891. *Diplosoma macdonaldi* Herdman, Journ. Linn. Soc. London, Zool., vol. 23, p. 633.
1898. *Diplosoma macdonaldi* Gottschaldt, Abh. Senckenb. Ges., vol. 24, p. 657.
1902. *Diplosoma macdonaldi* Van Name, Trans. Connecticut Acad. Sci., vol. 11, p. 368, pl. 53, fig. 60; pl. 60, fig. 124.
1909. *Leptoclinum macdonaldi* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl. p. 1455.

The only satisfactory specimens in the collection are two small colonies from station D5145, each about 10 mm. in greatest diameter and of a thickness of 2 to 3 mm. Each of them grew upon the carapace of a small living crab, arching over it so as to cover all but the lower parts and the appendages of the crustacean. Apparently the ascidians did not interfere with the life of the crabs, and though they must have inconvenienced them in locomotion, they doubtless afforded considerable protection and concealment. In addition to these specimens several very minute colonies (containing, however, adult zooids), certainly of this genus and presumably of this species, were found growing upon and among *Didemnum* colonies from station D5148.

Test nearly colorless and more or less transparent. It is fairly firm in consistency and does not contain very extensive common cloacal cavities or ducts.

Zooids 1.5 mm. long or less when moderately expanded; the intestinal loop, as well as the abdomen as a whole, are almost always, if not always, strongly bent to one side, so that an exact estimate of the length is difficult. Body only moderately constricted between the thorax and abdomen. Branchial aperture 6-lobed; atrial aperture neither produced into a tube nor provided with a languet.

Tentacles of three sizes, quite regularly arranged.

Much time and labor was expended in an attempt to demonstrate the dorsal languets, and it is believed that they were distinctly seen in several cases. The difficulty in distinguishing them is apparently due to their being long and slender and not greatly different in thickness from the interstigmatic vessels. Apparently they arise as usual from the transverse vessels of the left side, but quite near the median dorsal vessel.

Branchial sac with four rows of long narrow sigmata, apparently about 12 or 14 in a row on each side.

Esophagus long; stomach oval, somewhat larger at the cardiac end. Intestinal loop rather large, bent to one side, and more or less twisted. It has several valvelike constrictions.

Testes beside the intestinal loop; two in number, of oval form, connected with the origin of the common sperm duct (which is not spirally coiled) by very short branch ducts. Ovary situated along the initial part of the common sperm duct. Eggs mostly in a single series; the largest and most advanced in the posterior part.

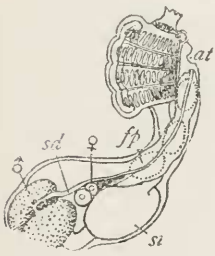


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FIG. 109.—LEPTOCLINUM MACDONALDI (HERDMAN). ZOOID. × 42.

Localities of the specimens above mentioned:

No. 78. Station D5145 (near Jolo Light, Feb. 15, 1908, 23 fathoms, coral sand and shells), (Cat. No. 5957, U.S.N.M.)

No. 162. Station D5148 (off Sirun Island, Sulu Archipelago, Feb. 16, 1908, 17 fathoms, coral sand).

Leptoclinum macdonaldi was described by Herdman (1886) from a specimen obtained by the *Challenger* expedition at Bahia, Brazil, in shallow water, and what appears to be the same species has also been found at Bermuda (Van Name, 1902). Gottschaldt (1898) records a colony from Ternate agreeing with Herdman's species. The widely separated localities are, of course, against the probability of their identity and naturally lead to the suspicion that with more abundant and better material specific differences might be discovered. A number of ascidians common to the West Indies and Malay region are, however, already known, and in this case the resemblance between specimens from Bermuda and those from the Philippines is certainly very close.

LEPTOCLINUM CALIFICIFORME Sluiter, 1909.

Plate 31, fig. 35.

1909. *Leptoclinum calificiforme* SLUITER *Siboga*-Exped., vol. 56*b*, p. 82, pl. 4, fig. 10. (Called *L. caliciforme* on p. 112.)

Colony flattened, slightly depressed in the central portion, and of irregular outline; the margins slightly elevated. Largest specimen about 22 mm. in greatest diameter and hardly over 2 mm. thick on an

average. Attachment only by a small area on the central part of the lower surface, the marginal portions of the colony being free. The general form of the colony is thus that of a flattened saucer of irregular outline. Surface of colony smooth and clean; test firm and tough, of a greenish white color; the tissues of the zooids are of a deeper greenish color, so that they show through the test quite distinctively. Superficial and marginal parts of colony translucent, free from zooids, but the marginal parts penetrated by vascular processes arising from the zooids and ending in bulbs, probably incipient buds. The zooids lie somewhat below the surface in a single layer rather closely placed, but between them are extensive common cloacal ducts or canals. Each colony probably contains only a single complex system with a centrally placed common cloacal aperture. The basal portions of the colony are of solid translucent test substance containing closely packed bladder cells, small irregularly shaped cells, and also larger round cells, which may be symbiotic algæ. These are, in the preserved specimens, almost colorless.

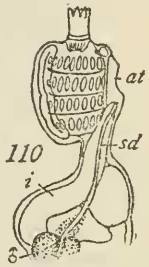

FIG. 110.—LEPTOCLINUM CALIFICIFORME SLUITER. ZOOID. × 50.

Zooids smaller than those of the last-described species, being generally considerably under 1 mm. long in the contracted state, and as noted below they have fewer tentacles and fewer stigmata in a row. They resemble them, however, in most characters, including, as far as could be detected, the absence of an atrial languet or atrial siphon. The branchial apertures are not always distinctly lobed.

Mantle musculature insignificant; a few slender longitudinal bands are present on the thorax.

Tentacles of two sizes, arranged in alternation.

Dorsal languets not demonstrated.

Branchial sac with 4 rows of stigmata; 8 or 9 on each side in the anterior rows, but apparently only 7 in the last row.

Stomach elliptical, somewhat elongated.

Reproductive organs were found only in a few of the zooids examined. The male organs resemble those of the species just described. The two testes were in all cases small and were apparently not fully developed.

Two colonies (No. 14) (Cat. No. 5956, U.S.N.M.), in the collection, both from Marongas Island, near Jolo, February 10, 1908.

Four small colonies in the United States National Museum, collected by Dr. L. E. Griffin and Mr. L. D. Wharton at Bantayan, may also belong here but are too immature and present too few distinctive characters for certain identification.

Sluiter (1909) described this species from a single small colony from the Sulu Archipelago (latitude 6° 7.5′ N.; longitude 120° 26′ E., 16–23 meters). He describes the colony as basin shaped, produced below into a short pedicel. The latter is not present in the *Albatross* specimens, but the colonies are basin or saucer shaped and attached only by a very small area of the lower surface. A colony of this form is very unusual in this genus or family.

Family SYNOICIDAE Hartmeyer, 1908.

[=POLYCLINIDAE Authors.]

Genus POLYCLINUM Savigny, 1816.

POLYCLINUM FESTUM Hartmeyer, 1905.

1905. *Polyclinum festum* Hartmeyer, Zool. Jahrbücher, Syst., suppl. vol. 8, p. 401, pl. 13, figs. 6 and 7.

1909. *Polyclinum festum* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1461.

Owing to mutilation and distortion, the specimens give little indication of the original form and mode of attachment of the colonies. The largest and best of them is an elongated flattened mass about 60 mm. long and nowhere much over 5 mm. thick. The area of attachment seems to have been small and much of the lower surface as well as the upper to have been free.

Test tough, brownish from diffused color; the tissues of the zooids are still browner though no distinct pigment cells were observed. Zooids apparently arranged in systems, but the form and limit of these are difficult to make out on account of the condition of the specimens.

Zooids large, when straightened out and not much contracted some measure 6 to 7 mm. long or even more. Thorax long and rather narrow, broad at the anterior end. Branchial aperture with six slightly bifid lobes; atrial aperture a plain round orifice, generally directed forward; between it and the base of the short branchial tube a long atrial languet arises. A narrow, constricted neck of varying length connects the thorax and abdomen, which is broad and of moderate length. A still narrower neck connects the abdomen with the small oval post-abdomen.

Mantle musculature slight. Slender, rather irregular longitudinal muscles are present on the thorax, some of them extending out on the atrial languet.

The tentacles appear to be of more than one size. They were not counted, but do not seem to be very numerous.

Dorsal languets, though probably present, were not demonstrated.

Branchial sac long and narrow, with at least 16 or 17 rows of stigmata in adult zooids, but the number in a row does not appear

to be large (perhaps about 14). Those near the endostyle become successively shorter. Esophagus long and narrow. Stomach oval, the esophageal end with a slight and the pyloric end with an extensive reentrant depression where the esophagus and intestine join the stomach. Stomach walls smooth and only moderately thick. Intestinal loop having the peculiar twisted course characteristic of the genus (see fig. 111) and provided with several valvelike constrictions. Anus two-lipped.

A dense group of 20 or 40 small oval testes occupy the anterior part of the postabdomen. Posterior to, or somewhat to one side of these, is the ovary, consisting of a group of eggs of different sizes, one or two of them often quite large. A large egg or young embryo is often present in the peribranchial cavity of the thorax. What appears to be the heart occupies the extreme posterior part of the abdomen.

The only specimens (No. 57, three colonies or fragments) (Cat. No. 5958, U.S.N.M.) are from station D5174 (off Jolo Light. Mar. 5, 1908, 20 fathoms, coarse sand). In most respects they agree well with Hartmeyer's type from Mauritius, the most striking difference being that he describes the test as transparent and the zooids showing through it plainly, giving the colony a yellow-brown color. Such a character would, however, be greatly affected by the methods and circumstances of the preservation of the specimen.

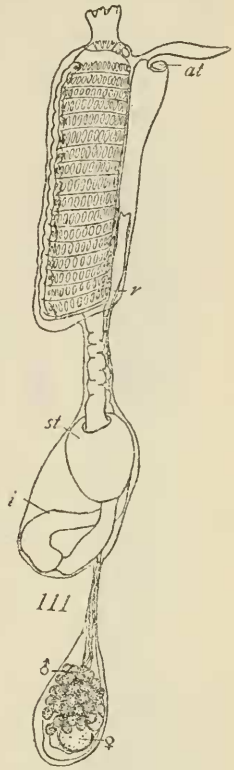

FIG. 111.—POLYCLINUM FESTUM HARTMEYER. ZOOID. × 14.

Genus AMAROUCIUM Milne-Edwards, 1841.

AMAROUCIUM CRATERIFERUM Sluiter, 1909.

Plate 33, figs. 45 and 46.

1909. *Amaroucium craterifcrum* SLUITER, *Siboga*-Exped., vol. 56*b*, p. 103, pl. 5, fig. 7; pl. 8, fig. 11.

1909. *Amaroucium craterifcrum* HARTMEYER, Bronn's Tier-reich, vol. 3, suppl., p. 1467.

Colony so irregular and variable in form in the different specimens that a general description is difficult. It is an irregular ovoid or convex mass whose shape is best described as a modification of the flattened capitate form, and is attached by an area variable in extent

and position. The surface is very uneven, with deep irregular folds and shallow depressions, and is usually quite thickly incrusted with sand, small fragments of shells, etc. These also occur to a considerable extent in the deeper parts of the colony. Dimensions of two of the largest specimens: 67 mm. long by 42 mm. wide, and 76 mm. long, 25 mm. high, and 18 mm. in greatest width. Test brownish, opaque, of a somewhat fibrous appearance, quite hard in the alcoholic specimens, though not very tough.

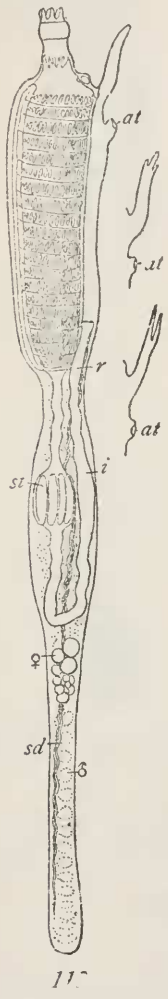

FIG. 112.—AMAROUCIUM CRATERIFERUM SLUITER. ZOOID. × 17.5. THE SMALL FIGURES SHOW VARIATIONS IN THE FORM OF THE ATRIAL LANGUET.

Zooids irregularly distributed, not very numerous in proportion to the amount of test substance. They are slender, the post-abdomen (which is very narrow) constituting over half their total length when well developed. Such zooids, even in the contracted state, may reach 8 or 9 mm. in length. Branchial aperture with six rather long lobes; atrial aperture on a low papilla on the anterior dorsal part of the thorax; ordinarily it is not lobed. Both apertures with strong sphincter muscles. A long, narrow atrial languet arises a little distance anterior to the atrial papilla. The languet may or may not be cleft into two or three lobes at its tip. (See different forms shown in fig. 112.)

Mantle musculature forming slender but distinct longitudinal bands on the thorax; on the ventral portion of the latter a deeper layer of transverse fibers can also be distinguished.

Tentacles rather few, of two sizes placed alternately.

Dorsal languets rather small, borne on the transverse vessels of the left side at a distance from the median dorsal vessel equal to the width of about four stigmata.

Branchial sac long and narrow, the transverse vessels conspicuously muscular. About 20 rows of stigmata, with 11 to 14 in a row on each side. In several zooids the writer found the lesser number to prevail on the right and the greater on the left side. The stigmata do not commence very close to the endostyle, and those near that organ are successively shorter in their dorso-ventral diameter; those near the median dorsal vessel are also slightly short-

ened. Variations and irregularities in their width occur in some individuals (perhaps largely because of irregular contraction of the walls of the sac); in others they are quite regular.

Intestinal loop rather long. Stomach with about 10 deep longitudinal plications in its wall. Ovary in the anterior part of the post-abdomen. The small pear-shaped testes are arranged along the common sperm duct throughout most of the length of the post-abdomen posterior to the ovary.

The specimens are all from the vicinity of Jolo and are from shallow water.

No. 31. Station D5144 (off Jolo Light, Feb. 15, 1908, 19 fathoms, coral sand.) (Cat. No. 5898, U.S.N.M.)

No. 23. Station D5145 (near Jolo Light, Feb. 15, 1908, 23 fathoms, coral sand and shells.) Cat. No. 5951, U.S.N.M.)

No. 26. Station D5145? (Locally indicated as doubtful.) (Cat. No. 5950, U.S.N.M.)

No. 145. Station D5174 (off Jolo Light, Mar. 5, 1908, 20 fathoms, coarse sand). (Cat. No. 5966, U.S.N.M.)

No. 45. Jolo, Jolo Island, February 11, 1908 (Cat. No. 5952, U.S.N.M.).

Sluiter (1909) described this species from a single colony, which, like the *Albatross* specimens, was also from Jolo, 14 meters.

AMAROUCIUM MULTIPLICATUM (Sluiter), 1909.

Plate 31, fig. 26.

1909. *Aplidium multiplicatum* Sluiter, *Siboga*-Exped., vol. 56*b*, p. 101, pl. 5, fig. 3.

1909. *Aplidium multiplicatum* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1469.

Small colonies usually rounded or more or less flattened, and sessile by a broad base; larger ones may be lobed or elongate and attached near one end. Largest colony 73 mm. long by 26 mm. in greatest width. Surface of colony smooth and shiny, the test more or less transparent so as to allow the zooids to show through in the best preserved specimens, but in those in poorer condition the surface may be furrowed and the test more or less opaque. Color light brown or yellowish brown, varying to yellowish white. Zooids arranged in more or less complex systems; common cloacal apertures rather few. Well expanded zooids may measure 7 mm. to 8 mm. long when the post-abdomen is well developed, but in the usual contracted state found in preserved material they are often only half the above length.

Branchial aperture 6-lobed; atrial aperture varying from distinctly lobed to nearly plain. An atrial languet of simple form arises slightly in front of the atrial aperture.

Thorax with numerous strong longitudinal muscle bands and less well-developed transverse muscles underlying them. Abdominal muscles mainly longitudinal and gathered into less definite bands than on the thorax.

Tentacles eight in number, of two orders placed alternately. Additional smaller ones were not certainly demonstrated.

Dorsal languets removed about the width of three stigmata to the left of the median dorsal vessel.

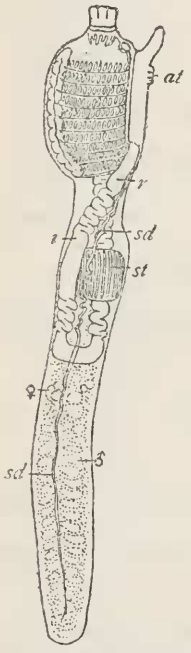

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FIG. 113. — AMAROUCIUM MULTIPLICATUM (SLUITER). ZOOID. × 20.

Branchial sac with 9 or 10 rows of stigmata; about 16 in a row on each side in the anterior part, but one or two less in the most posterior rows.

Stomach wall with a considerably larger number (18 or 20) of longitudinal plications in its walls than in the case of *Amaroucium crateriferum*. The plications are narrow and some of them are often, if not usually, more or less irregular in length and arrangement.

No peculiarities of the reproductive organs were noted. Ovaries poorly developed in the specimens examined; situated in the anterior part of the abdomen. The testes form a double series along the common sperm duct in the part of the post-abdomen behind the ovaries.

Localities of the *Albatross* specimens:

No. 84. Station (off Jolo Light, Feb. 15, 1908, 29 fathoms, coral sand). One colony (Cat. No. 5954, U.S.N.M.).

Nos. 86, 163. Station D5145 (near Jolo Light, Feb. 15, 1908, 23 fathoms, coral sand and shells). Several colonies (Cat. Nos. 5953 and 5965, respectively, U.S.N.M.).

Several additional colonies in the United States National Museum were collected by Mr. S. F. Light on eel grass in Porta Galera Bay, Mindoro.

Sluiter (1909) describes this ascidian from colonies from reefs at Tial, Ki Island, and Haingsisi, Saman Island. Except that they appear to have several more rows of stigmata (a character perhaps subject to variation with age as well as individually), the *Albatross* specimens agree accurately with Sluiter's description.

AMAROUCIUM CONSTRICTUM Sluiter, 1900.

1900. *Amaroucium constrictum* Sluiter, Zool. Jahrbücher, Syst., vol. 13, p. 17. pl. 1, fig. 8*a*.

1909. *Amaroucium constrictum* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1466.

Colony in the only specimen irregularly capitate, attached by a narrowed base. Test yellowish white, translucent, moderately firm, the brownish zooids visible through it indistinctly. Height about 12 mm.; greatest diameter of head, about 8 mm.

Zooids small; in none of them is the post-abdomen equal to the rest of the body in length. The individual figured was about 3 mm. long. Branchial aperture with 8 lobes; atrial aperture only indistinctly lobed, and not at all produced into a tube.

A well-developed atrial languet is present; it has a large middle lobe and small pointed lobe on each side.

Thorax with numerous longitudinal muscle bands.

Tentacles and dorsal languets not clearly made out.

Eight or nine rows of stigmata with apparently about 15 in a row on each side.

Stomach wall with 10 or 12 deep longitudinal plications.

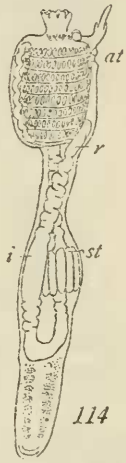

Fig. 114.—Amaroucium constrictum Sluiter. Zooid. × 20.

The only specimen (No. 29) (Cat. No. 5955, U.S.N.M.) is from station D5174 (off Jolo Light, Mar. 5, 1908, 20 fathoms, coarse sand). The species with which the writer identifies this specimen was described by Sluiter (1909) from the Chatham Islands.

Genus APLIDIUM Savigny, 1816.

APLIDIUM DEPRESSUM Sluiter, 1909.

1909. *Aplidium depressum* Sluiter *Siboga*-Exped., vol. 56*b*, p. 102, pl. 5, fig. 6.

1909. *Aplidium depressum* Hartmeyer, Bronn's Tier-reich, vol. 3, suppl., p. 1469.

Largest colony of rather thin flattened form and irregular in outline, the upper surface fairly smooth. Dimensions 26 mm. by 15 mm. across and not over 3 mm. thick at any point. Test fairly transparent, not pigmented, of only moderately firm consistency. The

two smaller colonies are of rounded outline, much flattened, but attached by a somewhat narrowed base.

Zooids easily visible through the test, very small (only 1.25 to 1.5 mm. long in the greatly contracted preserved state). Post-abdomen rather short in all the individuals. Branchial aperture 6-lobed, atrial on a more or less produced tubular projection arising about the middle of the dorsal part of the thorax. It is sometimes obscurely 6-lobed, in other cases not lobed at all. No atrial languet.

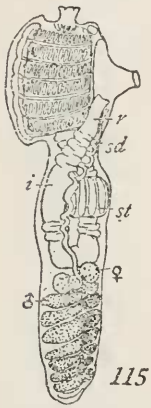

FIG. 115.—APLIDIUM DEPRESSUM SLUITER. ZOOID. × 34.

Mantle with distinct but rather widely spaced longitudinal muscle bands which are most conspicuous on the thorax. Numerous transverse fibers, quite near together but not gathered into bands, underlie the longitudinal bands on the thorax.

Tentacles, apparently about a dozen, of two sizes, placed alternately.

Dorsal languets not demonstrated.

Branchial sac rather short with comparatively few (probably about 6 or 7 rows of stigmata, with about 14 in a row on each side.

Stomach with about a dozen deep longitudinal plications.

Ovary consisting of a group of a few eggs of different sizes in the anterior part of the post-abdomen. Posterior to it the large pear-shaped or cuneate testes form a double series along the common sperm duct.

Localities:

No. 21. Station D5109 (off Corrigidor Light, Jan. 15, 1908, 10 fathoms, coral). One colony (Cat. No. 5903, U.S.N.M.)

No. 75. Station D5555 (off Cabalian Point, Jolo, Sept. 18, 1909, 34 fathoms, coarse sand). Two small colonies (Cat. No. 5902, U.S.N.M.).

The above-described specimens agree so nearly with Sluiter's (1909) description of *A. depressum* from latitude 7° 35′ S., longitude 117° 28.6′ E., that there seems to be no reason for regarding them as distinct, though Sluiter's specimen was from much deeper water (521 meters).

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EXPLANATION OF PLATES.

Plate 23.

Fig. 1. *Pandocia pedata* (Herdman). No. 97. Station D5218. Nat. size.
2. *Pandocia pedata* (Herdman). No. 157. Station D5164. Nat. size.
3. *Pandocia pedata* (Herdman). No. 158. Station D5250. Nat. size.

Plate 24.

Fig. 4. *Nephthcis thompsoni* (Herdman). No. 104. Station D5139. Two colonies. About seven-eights nat size.

Plate 25.

Figs. 5, 6. *Pandocia aurata* (Quoy and Gaimard). No. 131. Locality, South Toumindao. Two individuals, nat. size.

Plate 26.

Fig. 7. *Pandocia circumarata* (Sluiter). No. 112. Station D5144. Nat. size.
8. *Pandocia circumarata* (Sluiter). No. 116. Station D5174. Nat. size.
9. *Eusynstyela latericius* (Sluiter). No. 124. Station D5557. Nat. size.

Plate 27.

Fig. 10. *Phallusia depressiuscula* (Heller). No. 154. Locality, Endeavor Point. × 1.1.
11, 12. *Phallusia depressiuscula* (Heller). No. 122. Locality, Catbalogan Samar. Two individuals. × 1.1.
13. *Phallusia depressiuscula* (Heller). No. 55. Locality, Jolo, Jolo Island. × 1.1.

PLATE 28.

Fig. 14. *Rhopalopsis crassa* (Herdman). No. 38. Station D5165. Colony of three zooids. × 1.15.
15. *Cystodites philippinensis* (Herdman). No. 22. Station D5174. × 1.15.
16. *Didemnum ternatanum* (Gottschaldt). No. 156. No locality recorded. Colonies on eelgrass. ×1.15.

PLATE 29.

Fig. 17. *Stolonica styeliformis*, new species. No. 113. Station D5136. Colony incrusting a gorgonian and overgrown with colonies of *Didemnum ternatanum* (Gottschaldt) and a few small colonies of *Didemnum grande* (Herdman). Nat. size.
18. *Stolonica styeliformis*, new species. No. 130. Station D5134. Nat. size.
19. *Stolonica styeliformis*, new species. No. 121 (Type). Station D5174. Nat. size.

PLATE 30.

Figs. 20, 21, and 22. *Didemnum grande* (Herdman). No. 100. Station D5139. Three colonies, color white marbled with blackish. Nat. size.
23. *Didemnum grande* (Herdman). No. 7. Station D5145. Pure white colony. Nat. size.
24–25. *Didemnum ternatanum* (Gottschaldt). No. 109. Station D5154. Two colonies. Nat. size.

PLATE 31.

Fig. 26. *Amaroucium multiplicatum* (Sluiter). No. 86. Station D5145. Very slightly enlarged.
27. *Styela arcolata* (Heller). No. 88. Station D5147. Very slightly enlarged.
28. *Polycitor ianthinus* (Sluiter). No. 126. Station D5139. × 1.15.
29. *Clavelina dctorta* (Sluiter). No. 142. Station D5139. Very slightly enlarged.
30. *Polysyncraton dubium* (Sluiter). No. 2. Station D5150. Very slightly enlarged.
31. *Pandocia ovata* (Pizon). No. 150. Station D5149. × 1.15.
32. *Pyura duplicata*, new species. No. 51 (Type). Locality, Catbalogan, Samar. Specimen seen from dorsal side. Very slightly enlarged.
33. *Polyandrocarpa maxima* (Sluiter). No. 46. Station D5141. Colony very slightly enlarged.
34. *Pandocia quadrata* (Herdman). No. 30. Station D5536. Very slightly enlarged.
35. *Leptoclinum calificiforme* Sluiter. No. 14. Locality, Marongas Island. Colony seen from the concave upper surface. Very slightly enlarged.

PLATE 32.

Fig. 36. *Pyura pallida* (Heller). No. 138. Station D5147. × 0.9.
37. *Pyura pallida* (Heller). No. 139. D5163. × 0.9.
38. *Pyura pallida* (Heller). No. 132. Locality, Catbalogan, Samar. × 0.9.

FIG. 39. *Microcosmus exasperatus* Heller, overgrown with a colony of *Stolonica vesicularis*, new species. No. 135. (Type of latter species.) Station D5145. × 0.9.

40. *Styela tinaktae*, new species. No. 136. Station D5159. Two individuals. × 0.9.

41. *Polycitor torosus* Sluiter. No. 62. Station D5148. Colony seen from one side. Very slightly enlarged.

42. *Ctenyura intermedia*, new species, new genus. No. 140. Station D5536. Two individuals (cotypes) seen from the dorsal side. Very slightly enlarged.

43. *Polysyncraton dubium* Sluiter. No. 4. Station D5139. Very slightly enlarged.

PLATE 33.

FIG. 44. *Didemnum ternatanum* (Gottschaldt). No. 129. Locality, Mantacao Island. Colony seen from one side. Slightly reduced.

45. *Amaroucium crateriferum* Sluiter. No. 145. Station D5174. Slightly reduced.

46. *Amaroucium crateriferum* Sluiter. No. 45. Locality, Jolo, Jolo Island. Slightly reduced.

47. *Holozoa vallii* (Herdman). No. 115. Station D5148. Colony seen from one side. Slightly reduced.

48. *Holozoa vallii* (Herdman). No. 65. Station D5149. Slightly reduced.

49. *Polysyncraton dubium* Sluiter. No. 5. Station D5145. Colony growing upon and nearly enveloping a small crab. Showing the lower surface of the crab, the upper being entirely covered by the ascidian. Slightly reduced.